The NATIONAL GEOGRAPHIC MAGAZINE

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THE NATIONAL GEOGRAPHIC MAGAZINE

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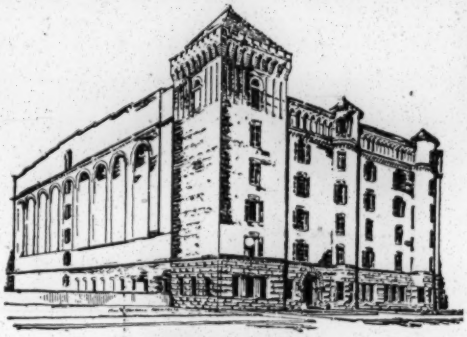

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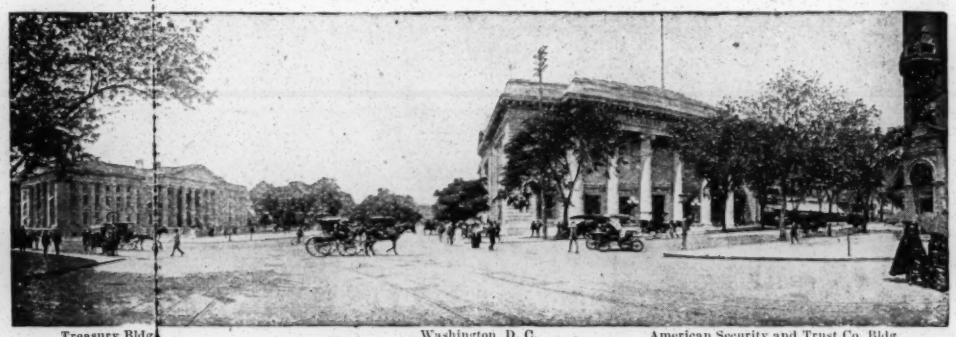

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VOL. XIX, No. 1. WASHINGTON JANUARY, 1908

THE NATIONAL GEOGRAPHIC MAGAZINE

IN THE SAVAGE SOUTH SEAS

By Beatrice Grimshaw

Miss Grimshaw is an enterprising young English woman who recently passed several years in Fiji and the New Hebrides on a search for good opportunities for investment. She explored many unknown sections of these islands and has written a delightful narrative of her travels and experiences, "Fiji and Its Possibilities." The following article is abstracted from this book, and is printed here through the courtesy of the publishers, Messrs Doubleday, Page & Company of New York, by whom all the extracts and illustrations are copyrighted.

FIJI is a British colony, situated in the southwest Pacific, lying between the 15th and 22d parallels of south latitude and between 157 east and 177 west longitude. It consists of 155 islands, with a total area of 7,400 square miles. Most of the land is contained in the two great islands of Viti Levu (Great Fiji) and Vanua Levu (Great Land), which account for 4,112 and 2,432 square miles respectively. These two islands are exceptionally well wooded and watered, and could, it is said, support three times the population of the whole group. Viti Levu is in every way the most important island in the archipelago. It contains the seat of government, the principal harbors, all the roads, and much the greater part of the colony's trade. There is one town in the group besides Suva—Levuka, the capital of former days, on the small island of Ovalau.

The climate is certainly hot, though the thermometer does not rise to any extraordinary heights. During the three hottest months—January, February, and March—the highest shade temperature ranges between 90° and 94° Fahr., and the lowest between 67° and 72°, roughly speaking. In the cooler months of June, July, and August, 59° and 89° are the usual extremes. The air is moist, as a rule, and in Suva, at all events, one may safely say that a day without any rain is almost unknown. On the northern side of Viti Levu the climate is a good deal drier and in consequence less relaxing. Dysentery is fairly common, but there is no fever to speak of, and the climate, on the whole, is considered healthful. Mosquitoes are so troublesome that most of the better class of private houses have at least one mosquito-proof room, with doors and windows protected by wire gauze.

As we pass down the main street of the capital, the curious mixture of the population is very noticeable—whites, half-castes, Samoans, Indians, Chinese,

and, more conspicuous than any, the Fijians themselves—tall, magnificently built people of a color between coffee and bronze, with stiff, brush-like hair, trained into a high "pompadour," clean shirts and smart short cotton kilts, and a general aspect of well-groomed neatness. They do not look at all like "savages" and, again, they have not the keen, intellectual expression of the Indians or the easy amiability of the Samoan type of countenance. They are partly Melanesian, partly Polynesian in type, and they form, it is quite evident, the connecting link between Eastern and Western Pacific.

East of Fiji, life is one long, lotus-eating dream, stirred only by occasional parties of pleasure, feasting, love-making, dancing, and a very little gardening work. Music is the soul of the people, beauty of face and movement is more the rule than the exception, and friendliness to strangers is carried almost to excess. Westward of the Fijis lie the dark, wicked, cannibal groups of the Solomons, Banks, and New Hebrides, where life is more like a nightmare than a dream; murder stalks openly in broad daylight, people are nearer to monkeys than human beings in aspect, and music and dancing are little practiced and in the rudest possible state.

In Fiji itself the nameless, dreamy charm of the eastern islands is not; but the gloom, the fevers, the repulsive people of the west are absent also. Life is rather a serious matter for the Fijian, on the whole; he is kept in order by his chiefs and by the British government, and has to get through enough work in a year to pay his taxes; also, if the supply of volunteers runs short, he is liable to be forcibly recruited for the armed native constabulary, and this is a fate that oppresses him a good deal—until he has accustomed himself to the discipline of the force, when he generally makes an excellent soldier. But, all in all, he has a pleasant time, in a pleasant, productive climate, and is a very pleasant person himself, hospitable in the highest degree, honest, good-natured, and clever with his hands, though of a less highly intellectual type than the Tongan or the Samoan.

A MARVELLOUS TRANSFORMATION

The whole penal apparatus is one gigantic jest, and is regarded as such by most of the whites and not a few of the natives.

To begin with, there is hardly any real crime, what there is being furnished chiefly by the Indian laborers employed on the estates of the Colonial Sugar Refining Company. The Fijians themselves, though less than two generations removed from the wild and wicked days of the Thakombau reign, are an extremely peaceable and good-natured people. In the fifties and sixties, and even later, murder, torture, and cannibalism were the chief diversions of a Fijian's life, and the power of working one's self into a more violent and unrestrained fit of rage than any one else of one's acquaintance was an elegant and much-sought-after accomplishment. This change, effected largely by the work of the missionaries, but also by the civilizing influences of the British government and of planters and traders innumerable, is most notable. Nothing can be more amiable and good-natured than the Fijian of today; no colored citizen in all the circle of the British colonies is less inclined to crime.

Yanggona (the "kava" of the eastern Pacific) is the universal drink of Fiji. It is the hard, woody root of a handsome bush (the *Piper methysticum*) which grows freely in the mountains. The Fijians prepare the root by grating or pounding, pour water over the pounded mass, and strain it through a wisp of bark fiber. The resulting drink looks like muddy water and tastes much the same, with a flavor of pepper and salt added. One soon gets to like it, however, and drunk in moderation it is extremely refreshing and thirst-quenching. The Fijians do not drink moderately, I regret to say; they often sit up all night over their yanggona, drinking until they

THE VILLAGE PLATÉ, FIJI

A ROOT OF YANGGONA FROM WHICH THE INTOXICATING DRINK OF THE FIJIAN ISLANDERS IS MADE

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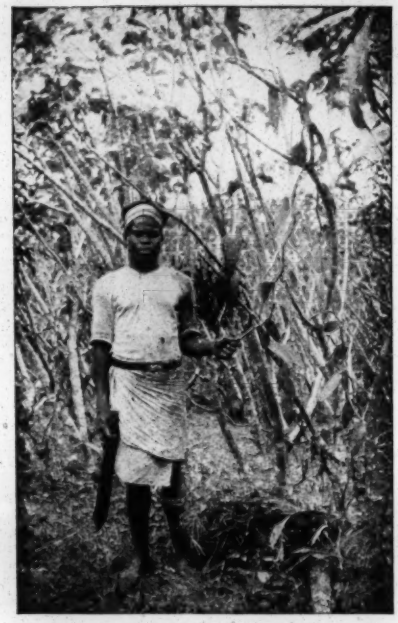
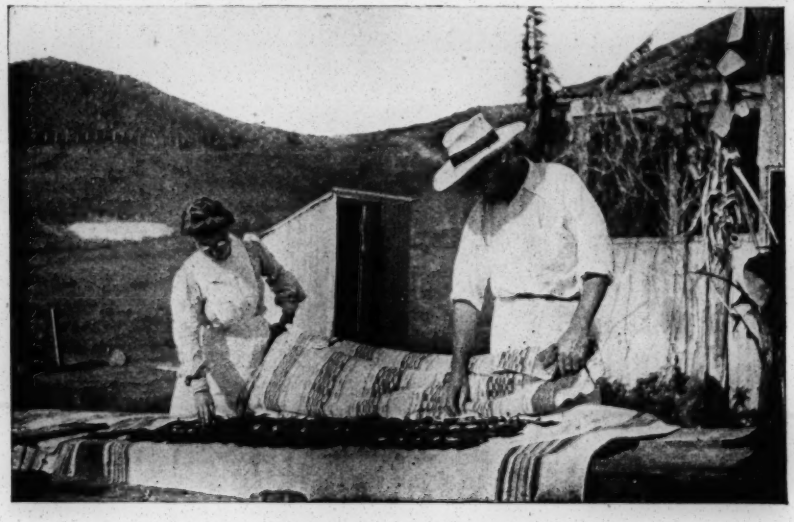


VANILLA PLANT AND BEAN

are stupefied and sleepy and quite unable to walk, for yanggona taken in excess paralyses the legs for an hour or two, even though the head may be quite clear. The British government has forbidden the ancient method of preparing the root, in which it was chewed and spat out into the bowl, instead of being pounded. For all that, yanggona is very frequently chewed at the present day, when no white people are about.

There are no woods in the world more beautiful and valuable than the woods of Fiji, although want of capital and, to some extent, want of enterprise has prevented their becoming widely known. "Bua-bua," the boxwood of the Pacific, is very common and grows to an immense size. It weighs 80 pounds to the cubic foot, is very hard, and most durable. The "cevua," or bastard sandalwood, a strong-scented, very durable wood, grows freely in logs one foot and two feet in diameter; and the real sandalwood is also found, though not plentifully. Another useful wood is "vesi," which grows two and three feet in diameter. It is much like teak—hard, heavy, and extremely lasting in the ground or out of doors; it is also rich-colored and very easily polished. The "dakua" is one of the most valuable woods; it much resembles the New Zealand kauri pine and grows to a large size, sometimes six and seven feet in diameter. It contains a great deal of gum, and quantities of this can be taken out of the ground wherever a tree



DRYING VANILLA, FIJI

A FIJIAN IN SUNDAY DRESS, FIJI

A FIJIAN IN FESTIVAL DRESS

INFANT HEAD-BINDING TO MAKE THE HEAD CONICAL, NEW HEBRIDES (SEE PAGE 17)

has been. The timber is useful for almost any purpose. The "yaka" might be called the rosewood of the Pacific, if it did not also, in some degree, resemble mahogany. It is a wood of the greatest beauty, being exquisitely marked and veined and taking a high polish. This is a wood that certainly should be known to cabinet-makers, and no doubt will be later on. The "savairabunidamu," a curious dark-red wood, is extraordinarily tough, and can be steamed and bent to almost any shape—a valuable quality. The "bau vundi" is a kind of cedar, very workable and most lasting. A singularly beautiful timber is the "bau ndina," which is deep rose-red in color, tough and firm, and suitable for engravers' use. Besides these, there are more than sixty varieties of other woods, all useful or beautiful and most to be found in great profusion. The quantities available are very large.

UNCANNY INSECTS

The wonderful stick insects of Fiji, familiar in all home museums, are found on nearly every cocoanut tree. They are very ill-smelling, and squirt a fetid fluid at one's eyes, if handled. Leaf insects I never saw, except when the natives caught and brought them to me, but all the guava bushes have them, although a white man's eye can seldom distinguish them from their shelter. They are most miraculous and uncanny creatures, absolutely leaves endowed with the power of motion, so far as the most scrutinizing eye can see, for even their legs and heads are a precise copy of stalks and small leaflets.

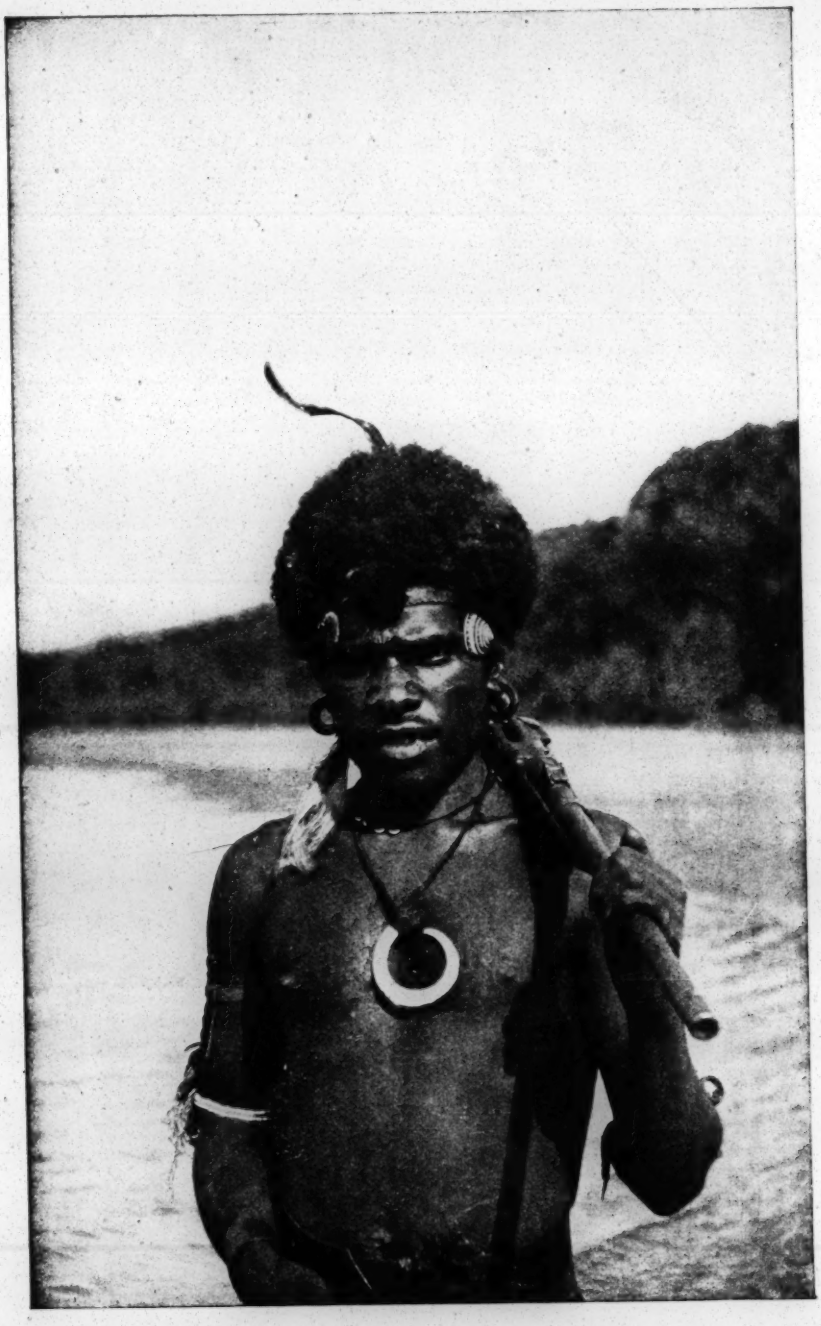
A certain enterprising man and his wife, who were getting rich very slowly indeed keeping a country store, resolved to try whether the magic bean might not do for them what it had done for others in South America and the West Indies. So, in the face of some actual opposition and continual ridicule, they expended their little capital of 250 pounds on the leasing of eight acres of warm, sheltered valley land and the planting of 9,000 cuttings of good Mexican vanilla. For three years, with the assistance of one Fijian and occasionally a couple of Indians, the industrious couple kept their plants weeded and tended, and latterly looked to the fertilizing of the flowers—a rather tedious business, done every day by hand, in the earliest hours of the morning; and at the end of the three years the reward came, for the plants were yielding splendidly and were expected to give about 9,000 pounds of dried beans, bringing an average price of 10 shillings a pound. The fruits of the first season were just coming in when I visited the plantation, and the lucky young couple were counting up their gains, present and future, with joyful hearts.

SULLEN NEW HEBRIDES

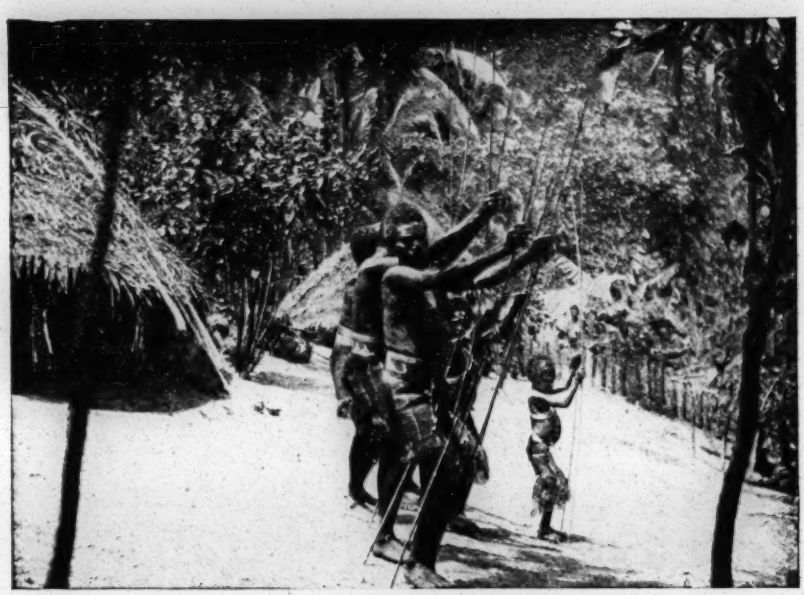
The New Hebrides are not very far from Australia—only about 1,500 miles northeast of Sydney—and they are by no means an insignificant group, since they extend over seven hundred miles of sea, and some of the islands are sixty and seventy miles long.

The native population is variously estimated at 60,000 to 100,000, and there are about three hundred French settlers and less than two hundred British and colonials, most of whom are missionaries.

The islands are extremely beautiful and remarkably fertile. Three crops of maize a year can be raised with little trouble. Coffee is largely grown, and there is none better in the Pacific. Millet, for broom-making, grows readily and pays well. Copra can be produced in the New Hebrides to better advantage than in any of the British Pacific colonies, the Solomons only excepted. Eighty nuts a tree is considered a very good average over the greater part of the South Seas. In the New Hebrides the figures I received seemed almost beyond belief, but, even allowing for much exaggeration, it seems certain that the average yearly crop of nuts must be quite twice as large as in Fiji, the Cook Islands, or Tonga. I saw more than one tree that had three hundred nuts at once upon it (as I was in-



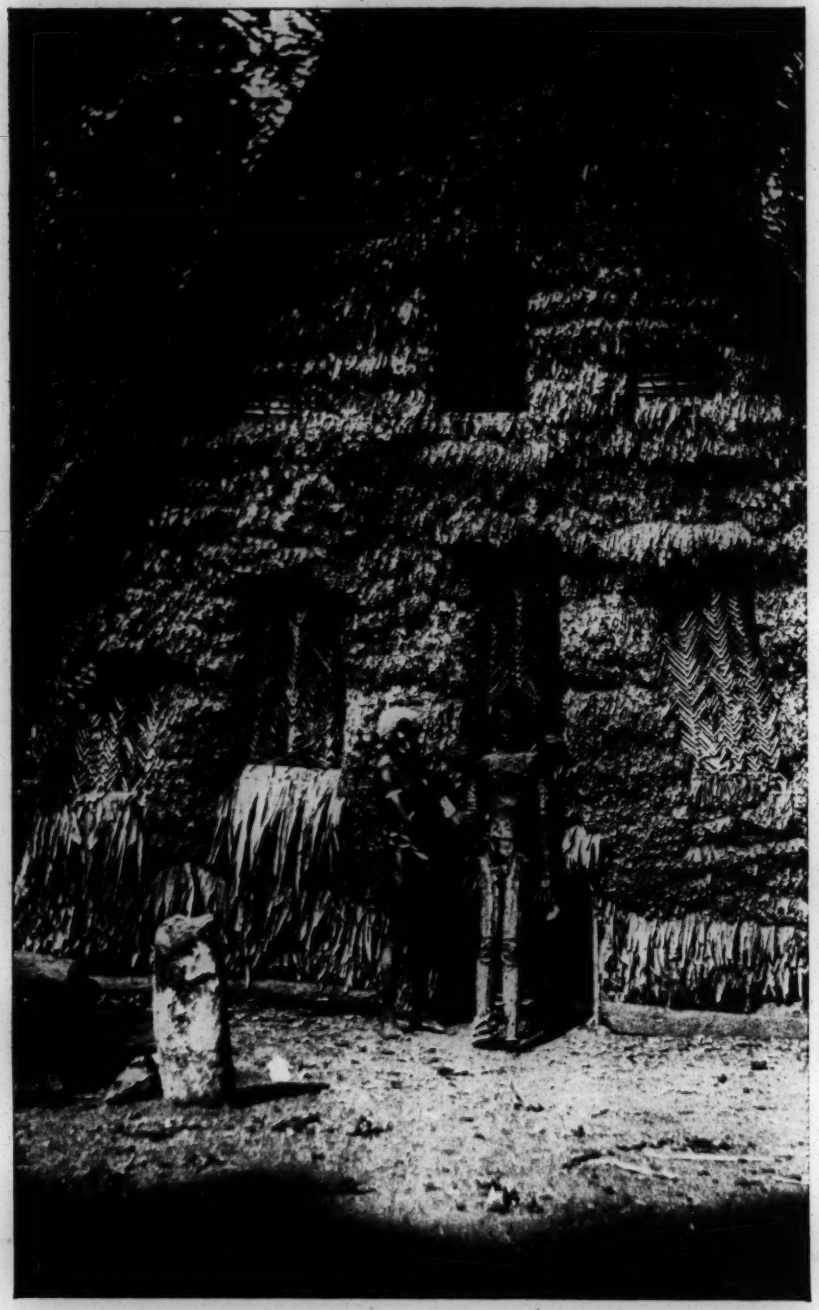
MALEKULA WARRIOR, NEW HEBRIDES



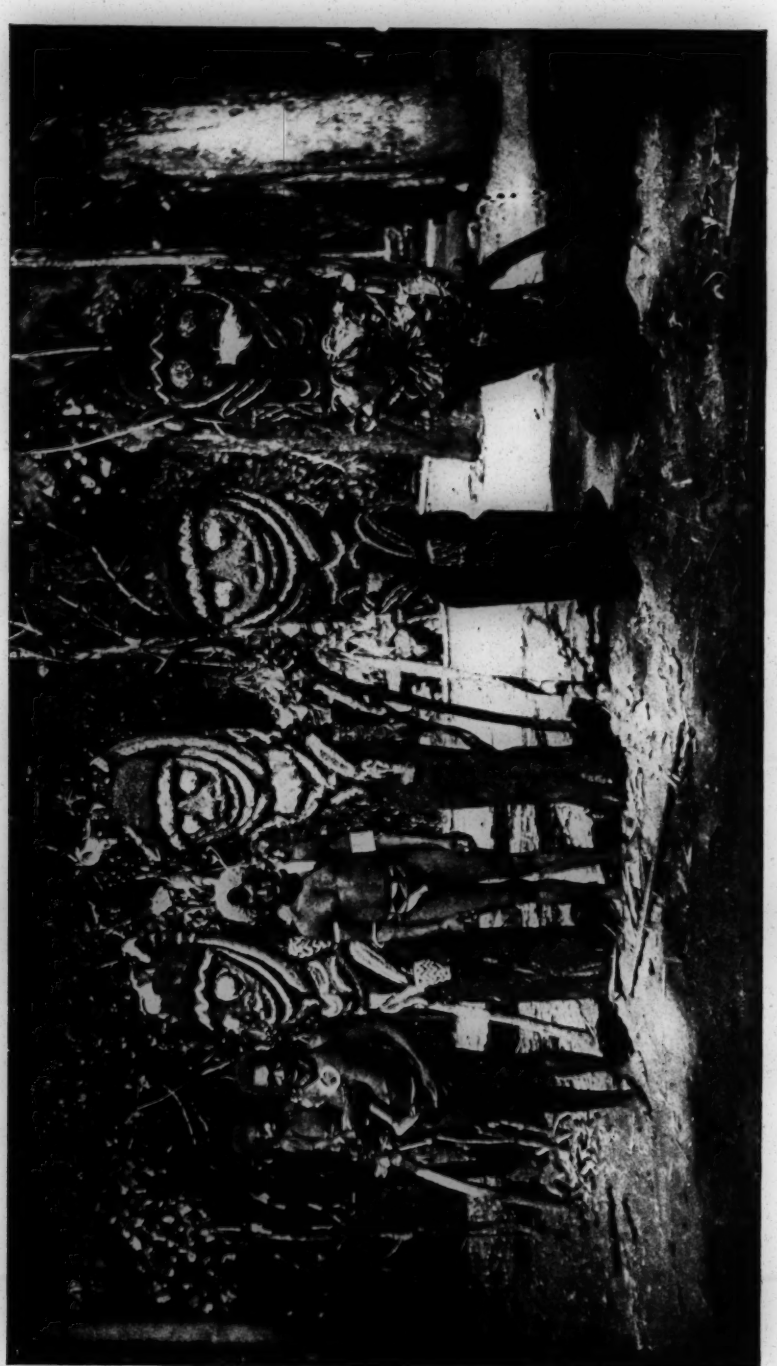
THE WOMEN'S DANCE

DANCING AND SINGING

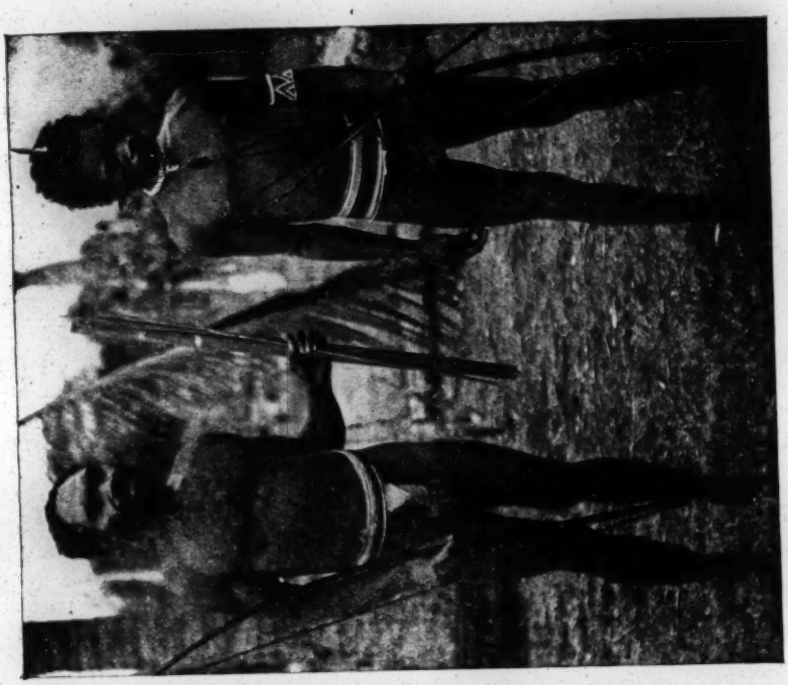
SCENES IN NEW HEBRIDES



BRINGING OUT THE MUMMY FROM THE "HAMAL" (SEE PAGE 17)

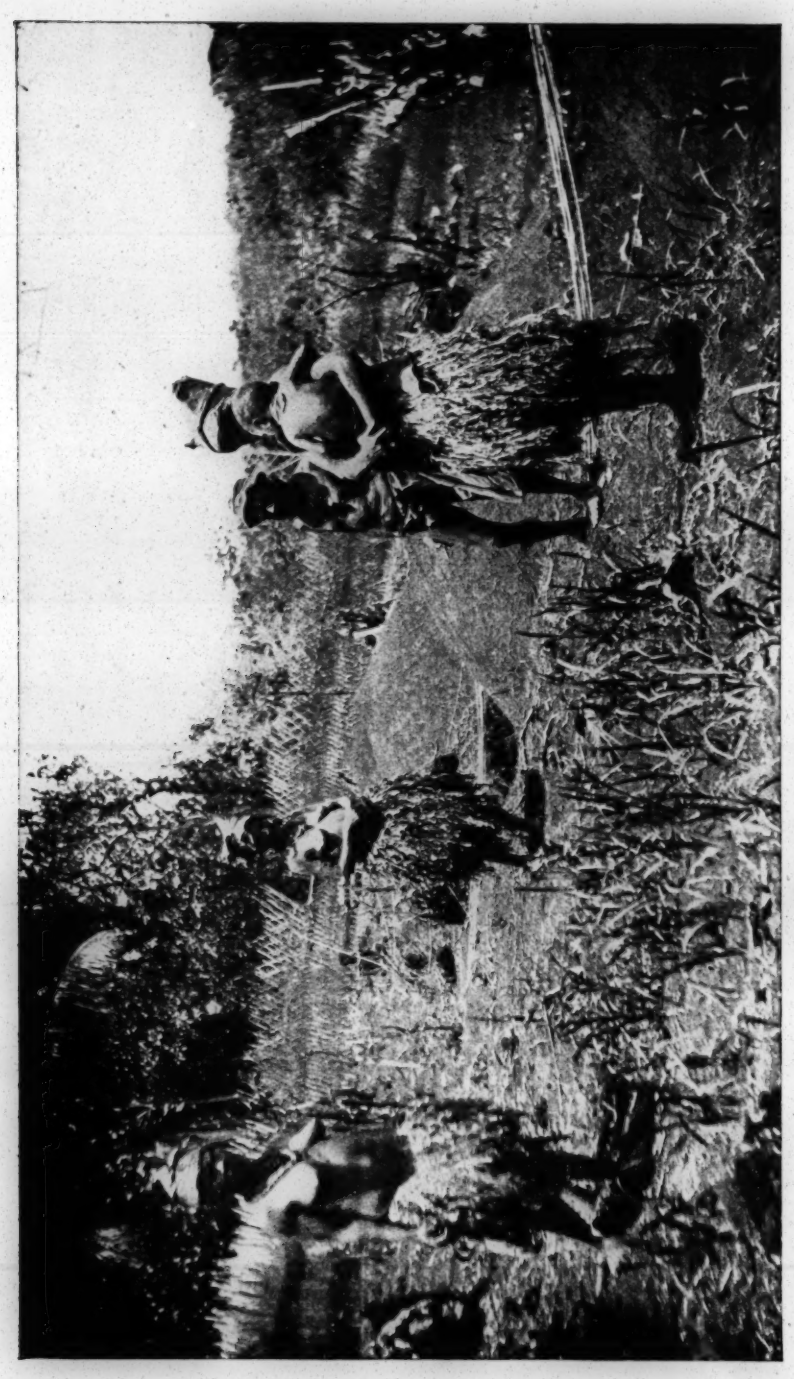


TYPICAL IDOLS IN A NEW HEBRIDES VILLAGE (SEE PAGE 18)



POISONED ARROWS

A NOTORIOUS CANNIBAL, NEW HEBRIDES



IN THE YAM FIELDS, NEW HEBRIDES

SHOOTING FISH, NEW HEBRIDES

formed; I did not count them, since that would have involved going up the tree with a paint-pot and a brush to mark them off), and I heard of one or two that had four and even five hundred.

This is a more important matter than might appear at first, for the copra trade is the true gold-mine of the Pacific. The oil that is expressed from the dried nut kernels is used in many different departments of commerce, especially in soap-making, and the demand constantly exceeds the available supply—so much so that the well-known firm of Lever Brothers have been buying up large tracts of land in the British Solomons to keep their factories supplied.

The popular idea of the New Hebridean, for a wonder, comes very near the truth. He is supposed to be, and is, treacherous, murderous, and vindictive. He is to the full as sensual and indolent as the Eastern Islander and lacks almost every virtue possessed by the latter. He is almost inconceivably clumsy and stupid in a house or on a plantation; almost devoid of gratitude, almost bare of natural affection; ready to avenge the smallest slight by a bloody murder, but too cowardly to meet an enemy face to face. Yet there are a few things to say in his favor. He is wonderfully honest—so much so that in the bush districts a coin or a lump of tobacco found by the wayside will never be appropriated by the finder, but will be placed in a cleft stick at the edge of the track, for the real owner to take the next time he may chance to pass that way; and if the possessor never returns, the "find" will remain where it has been placed until some white man or some "civilized" native from a plantation passes by and appropriates it.

One of the strange things seen in one village was the collections of boars' tusks belonging to the chiefs. These were displayed on a long stand that exactly resembled eight or ten bazaar stalls joined together. There were some hundreds of them placed in long rows—how many exactly I had not time to count, as I heard that the canoes were just coming home from the mainland and I wanted to be on the shore to meet them. Many of the tusks were curved into a complete

TANNESE SCAR-TATTOOING, NEW HEBRIDES

LOOKING OUT FOR TROUBLE

THE ALLIES COMING IN

Villages are surrounded by stockades made of interwoven reeds

double circle. These are greatly prized, but are only obtained at the cost of much suffering to the unlucky pig that furnishes them. He is tied up in a house and never allowed to wander forth, for fear of destroying his tusks. From each side of the jaw the teeth that oppose the tusk and prevent its going too far are removed, so that in time it grows right round through the unlucky animal's flesh and provides a splendid double armlet for the native who owns the pig.

In Malekula, one of the larger islands of the New Hebrides, many a married woman was distinguished by a dark gap in the ivory-white teeth of her upper jaw, where the two middle incisors had been knocked out with a stone. This extremely unpleasant substitute for the wedding ring is found in various parts of Malekula. The operation is performed by the old women of the tribe, who greatly enjoy the revenge they are thus enabled to take on the younger generation for the injury once inflicted by their elders upon them.

By a good deal of worrying and a little tobacco, I persuaded the villagers to show me a mummy from one of their "hamals," or sacred houses.

It appeared to be the stuffed skin of a man fastened on poles that ran through the legs and out at the shoulders. The fingers of the hands dangled loose like empty gloves. The hair was still on the head, and the face was represented by a rather cleverly modeled mask made of vegetable fiber, glued together with bread-fruit juice. In the eye-sockets the artist had placed neat little circular coils of cocoanut leaf, and imitation bracelets were painted on the arms. The face and a good part of the body were colored bright red. The ends of the stretcher-poles were carved into a curious likeness of turtle heads. Standing up there in the dancing light and shade of the trees, against the high brown wall of the hamal, the creature looked extraordinarily weird and goblin-like. It had a phantom grin on its face, and its loose skinny fingers moved in the current of the strong trade wind—it certainly looked more than half alive.

MAKING A CONICAL HEAD

It was while I was staying with the kindly and hospitable B——s that I had the chance of photographing what I believe has never been photographed before—the making of a conical head.

A good many years ago certain men of science who had procured skulls from all parts of the world were struck with the extraordinary egg-like shape of some that came from Malekula. No one knew much about the people who owned these remarkable heads, and science forthwith erected rather a pretty theory on the basis furnished by the skulls, placing the owners on the lowest rung of the human ladder and inferring that they were nearer to the ape than any other type at that time known.

Later on some one happened to discover how it was that the skulls came to show this peculiar shape, and the marvel vanished when it was known that compression in infancy was the cause. It is still, however, a thing curious enough. Several other nations compress their infants' heads, but none seems to attain quite such a striking result as the Malekulan, in those districts where the custom is systematically practiced. A conical head, when really well done, rises up to a most extraordinary point, and at the same time retreats from the forehead in such a manner that one is amazed to know the owner of this remarkable profile preserves his or her proper senses, such as they are. I could not hear, however, that the custom was supposed to affect the intellect in any way.

"It would be hard to affect what they haven't got," a trader observed on this subject.

The conical shape is produced by winding strong sinnet cord spirally about the heads of young babies, and tightening the coils from time to time. A piece of plaited mat is first put on the head, and the cord is coiled over this, so as to give it a good purchase. The crown of the

head is left to develop in the upward and backward fashion that is so much admired. One fears the poor babies suffer very much from the process. The child I saw was fretful and crying and looked as if it were constantly in pain; but the mother, forgetting for the moment her fear of the strange white woman, showed it to me quite proudly, pointing out the cords with a smile.

She had a normally shaped head herself, and it seemed that she had suffered by her parents' neglect of this important matter, for she was married to a man who was of no particular account. A young girl who was standing beside her when I took the photograph had evidently had a more careful mother, for her head was almost sugar-loaf-shaped. It is interesting to know that this well-brought-up young woman had married a chief.

STRANGE WOODEN IMAGES OF ANCESTORS

A visitor to the island of Malekula, New Hebrides, is greatly impressed by the huge images in the amils, or village squares; they are rudely carved, barbarously painted, and are called "temes," or images of the dead.

These images differ greatly from each other. Some are made of wood, others of the butt of a fern tree; some are painted in scrolls or stripes, others in rings; some display only a head, others are rude effigies of the whole human body; in some the eyes are round, in others oval-shaped.

The colors employed in olden times were coral lime, yellow ocher, a mineral green, and charcial. Civilization, through the trader, has supplanted the green and yellow with the laundry blue and red lead. They are more brilliant, no doubt, but less in keeping with their surroundings.

A remarkable fact is, that although the images are rude in design and out of all proportion, they are real attempts at portraying the human figure. Every part is carefully put in; yet, with the exception of the boar's tusks on one, there is an entire absence of the combination of the human and animal, as, *e. g.*, in the Hindu pantheon. This is possibly due to imperfect and rudimentary notions of divinity, if these are at all gods. There are no figures, like the Ephesian Diana, denoting the nourishment of man and beast from many-breasted Nature. There are no many-headed or many-eyed emblems of the omnipotence or omniscience of the gods. We are still among the lowest and rudest forms of religion.

The people of Tanna, another island of New Hebrides, are a remarkable race and, in spite of their murderous tendencies, have a great deal more character than the Malekulans. Queenlanders know them well, for thousands of Tannese have been employed in the Queensland sugar country from time to time. Whatever they may have gathered of civilization in Australia stays with them but a little while after they leave. On landing they generally take off all their clothes, go back to their villages, paint their faces, and take a hand in the latest tribal row, only too glad to be back to savagery again.

Like the Fijians, who were at one time the fiercest and most brutal cannibals of the Pacific, and who are now a peaceful and respecting nation, worthy of the crown that owns them, the Tannese will in all probability "train on" into a really fine race, as soon as they can be restrained from continuously murdering each other on the slightest provocation, and induced to clean their houses and themselves and live decently and quietly.

The yam gardens were weariful pictures. In one that we passed nearly all the women had blackened faces, the Tannese sign of mourning. The yam garden was a waste of parched and powdery earth; the bush around was burned yellow and brown; the pale-blue sky above quivered with the fierce midday heat. Stolid, ugly, and streaming with sweat, the women worked dully on, breaking off for a few minutes to stare and wonder at the visitor, and then continued their heavy task.

XUM

BUSHMEN COMING TO SEE A WHITE CHILD

FASHIONS IN ERROMANGA, NEW HEBRIDES

STUDIES ON THE RATE OF EVAPORATION AT RENO, NEVADA, AND IN THE SALTON SINK

By Professor Frank H. Bigelow

U. S. Weather Bureau

THE southwestern United States, from southern Utah and Colorado, including Arizona and New Mexico, to southern California, is the wonderland of North America. Here are found several hundred square miles of petrified forests, the surface of the ground being covered with agate tree trunks and chips; the largest natural bridge in the world, 500 feet span, 200 feet high, and 600 feet wide; the greatest examples of volcanic action, with 50 miles of lava in sheets 1,500 feet thick; the most impressive villages of cave-dwellings in the world; the many-storied cliff-houses of aboriginal architecture; the communes or town republics and the pueblos of the Acoma and Moki Indians; the most notable tribes of nomad Indians, the Navajos and Apaches, who are the best fighters of the savage world; and the remarkable ruins of the great stone and adobe churches of the Franciscan missionaries.

The greatest wonder of all is the work of erosion performed by the Colorado River in its course from Utah to the Gulf of California, a distance of 2,000 miles. At present it flows through the Grand Canyon in a narrow gorge about 1,300 feet deep below the first level of the valley; but this valley itself is surrounded by cliffs and pinnacles rising 5,000 to 6,000 feet above the water of the river; also, passing from the rim of the canyon along the open prairie to the mesas, or tables, still marking the ancient levels of the plateau, yet another thousand feet must be added. The geological evidence shows that more than 30,000 feet of rock have been carried away in some places, and that over a region covering 200,000 square miles at least 6,000 feet have been transferred to the ocean.

The cutting of the gorge through 800 feet of black gneiss, 800 feet of quartz, 500 feet of sandstone, 3,600 feet of limestones of various kinds, and 1,000 feet of gypsum mixed with limestone is a manifestation of water power hard to appreciate.

The Colorado River drains the snow water of the Rocky Mountains and the plateau southwestward, and has gradually transported this immense mass of material into the Gulf of California. In ancient days this gulf extended about 150 miles farther north, between the San Jacinto and the San Bernardino Mountain ranges, and the beach lines of this old sea can be readily traced upon the sides of the mountains 15 feet above sea-level. The river entered the old Gulf of California at Yuma, Arizona, and it has gradually built a delta of silt and débris directly across the gulf, so that the northern end of the ancient depression has been entirely cut off from the Pacific Ocean and its waters. This sink is now about 285 feet below sea-level in the Salton Sea, while the delta floor is 20 to 40 feet above sea-level.

The waters of the Colorado River pass through a narrow channel at the heads above Yuma and flow along the top of the delta in channels which are readily shifted to the north or the south, this being the natural way to spread more soil over an ever-widening delta back. The gradient of flow is steeper northward to the Salton Sink than it is southward to the Gulf of California, and hence any flowing of the river to the deep sink is

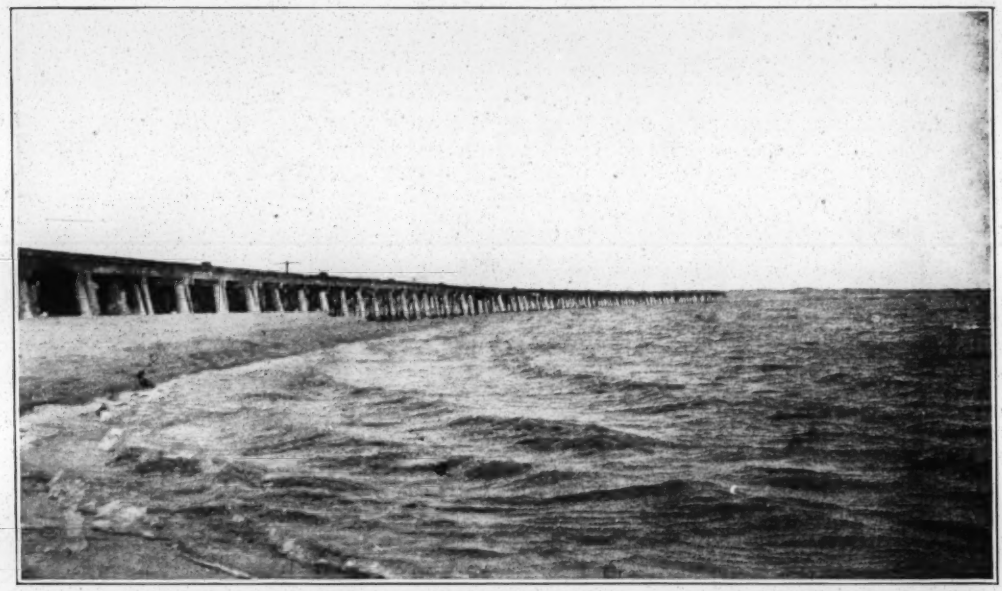


Photo by F. H. Bigelow

THE SALTON SEA AND THE SALT CREEK TRESTLE

Of the Southern Pacific Railroad, about 800 feet long. The water is too rough on calm days to float pans; the waves are from 8 to 12 feet high in heavy weather

accompanied by a series of rapids, in consequence of which the soluble soil of the delta is peculiarly subjected to rapid cutting and erosion and the soil is transported northward in great masses. This alternate flowing of the river to the north and south has occurred many times in geological history, the Salton Sea forming suddenly and drying out more gradually by the slower process of evaporation, though this is unusually rapid in that hot and arid climate.

The desert regions east of the Coast Range of southern California are caused by the fact that the mountains cut off the moist west winds from the Pacific Ocean, while the entire region is too far west of the Gulf of Mexico to receive any moisture from its southerly winds.

TEN CROPS OF ALFALFA A YEAR

The latest overflow of the Colorado River into the Salton Sink occurred in 1905-1906, as the result of certain irrigation projects. The soil of the delta, being the product of the mountains of Utah, New Mexico, and Arizona, is particularly fertile, when supplied with irrigated water, on account of the continuous high temperature, which ranges from 120° in July and August down to about 20° to 30° in January and February. This is shown by the fact that about ten crops of alfalfa can be cut annually from the same ground without fertilization, and that crops of canteloupes are ready for market as much as 30 days earlier than any other region of the United States, all other vegetable crops flourishing in the same abundant ratio.

The Department of Agriculture finds that its new date farms at Indio and Mecca, just north of the Salton Sea, are producing dates and figs of a very superior quality, and it is supposed that in less than 20 years that region will provide all the dates consumed in the United States, as much as 20,000,000 pounds annually.

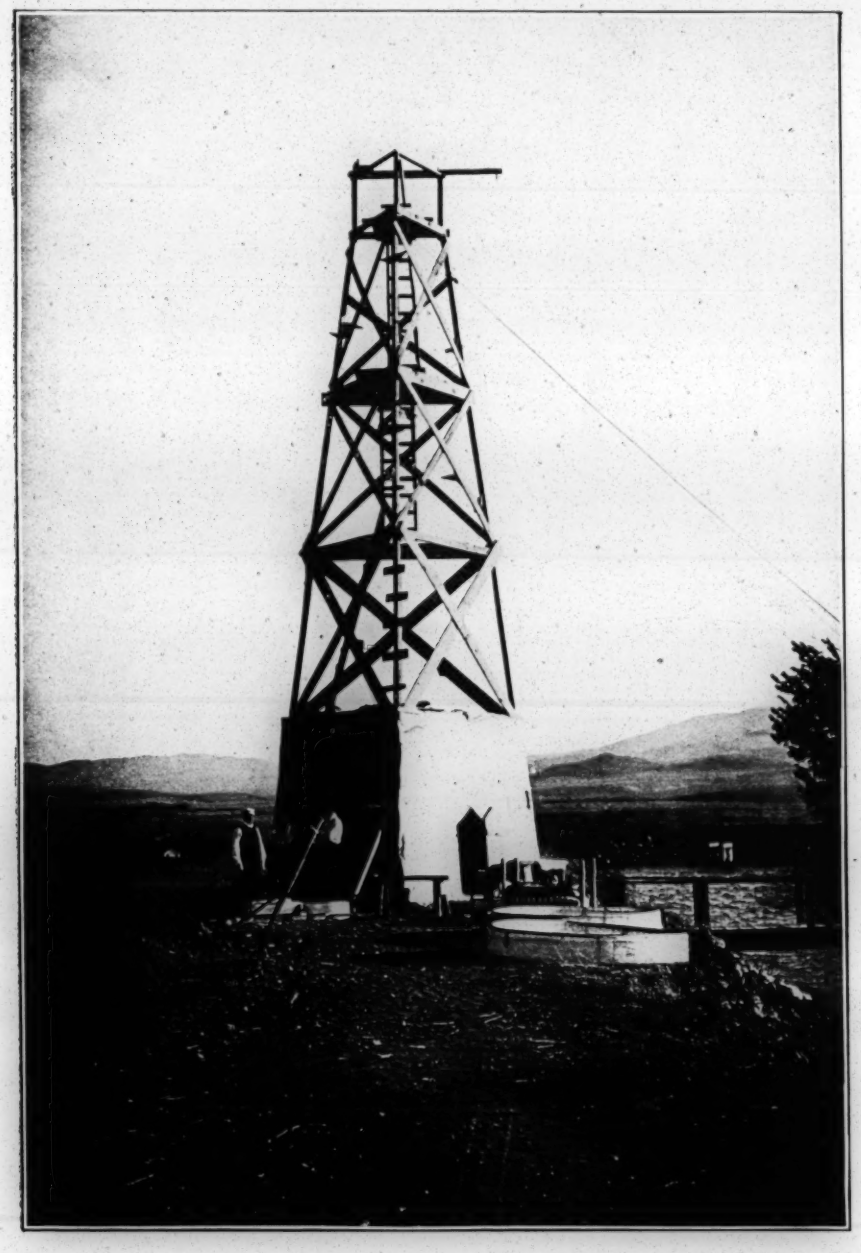


Photo by J. E. Church, Jr.

RENO RESERVOIR, TOWER NO. 2

Showing two six-foot evaporating pans and the landings for four two-foot pans

This fertile soil has attracted large irrigation projects over the Imperial Valley, south of the Sink, where 15,000 to 20,000 people are now engaged in putting 400 square miles of country under irrigation by means of canals from the Colorado River. It was while this canal system was being constructed, with inadequate headgates at the river, in the soluble soil, that in 1905 the headings opened by wearing in the banks and let the entire waters of the river flow down the steep gradients to the north. The Imperial Canal, the Alamo and the New rivers became raging torrents and cut away immense masses of country, which was transported into the Salton Sink. At Brawley the Alamo River was cut down from a shallow channel to a gorge 60 feet deep, and it spread out many hundred feet near the sea; also the New River, which at Brawley is 6 miles west of the Alamo River, now has a bed 800 feet wide and 80 feet deep, whereas it was lately only a shallow stream. The entire system of canals constructed by the California Development Company became disorganized, many towns were injured, and it is estimated that $400,000,000 of property was in jeopardy.

To meet this emergency the Southern Pacific Railroad Company undertook, in connection with the Development Company and the U. S. engineers, of the Reclamation Service, to build suitable levees to control the future course of the Colorado River, and in February, 1907, after several disappointing failures, this was finally accomplished. The new levees withstood the floods of June with a stage of about 30 feet, and there is every reason to believe that the Colorado River will be permanently diverted to the southern slopes of its delta instead of to the northern, as was recently its course.

KNOWLEDGE OF THE RATE OF EVAPORATION VERY NECESSARY

The result of this temporary flow of the river to the Salton Sink was to make a lake of fresh water about 45 miles long, 10 to 15 miles wide, containing 440 square miles of water surface, having a depth of 80 feet in the middle.

In May, 1907, the surface of the sea was 205 feet below sea-level, and in October it had fallen to about 207.5 feet. This loss is due to evaporation, but the actual evaporation should be made to include the amount that has been added through the flow of the Alamo and New rivers, which has been quite considerable. During the past year, while the canals were only partially repaired, more water flowed to the sea than will be the case after the beginning of 1908, when operations for irrigation will be fully resumed for that season.

It has been supposed quite generally that as much as 8 feet of the Salton Sea would evaporate annually, though we now have reasons to think it may not be more than 4 or 5 feet, as will be shown from the results of the Reno work. It is evident that, as the sea evaporates, in the course of a few years we shall have a series of lakes of different sizes, and that in general this sea gives us an unusually good opportunity to study the subject of evaporation on a large scale and under favorable conditions. Mr G. K. Gilbert, of the Geological Survey, proposed that the government should take up this subject, because the theory of evaporation in application to bodies of water in the open is very unsatisfactorily understood, as shown by the discordant results of several researches along this line.

The engineers of the irrigation projects require to know how much a given area of water surface will evaporate in a given climate, in order that the dams may be built at an economic height, and that they may know how much water will be available for distribution to farmers. The engineers of water-works systems for large cities, especially in the arid West, need such information in a reliable form as a factor in their estimate of resources. The meteorologists also require the same knowledge to supplement their observations on precipitation. For example, in the United States, east of the Mississippi

River, the precipitation and the evaporation are about equal to each other—40 inches per year; on the Rocky Mountain plateau the precipitation is about 20 inches and the evaporation 60 inches, and in the southwestern states the precipitation is only 10 inches and the evaporation 80 inches. The available water is therefore derived from the melting snows of the mountains, brought under control by the rivers and the canals to the fertile soils of the arid regions, and this means the construction of storage basins, which are subjected to intense evaporation.

Mr Gilbert's suggestion resulted in a conference board from the U. S. Geological Survey, the U. S. Reclamation Service, and the U. S. Weather Bureau visiting the Salton Sea and reporting that the project of studying the laws of evaporation at the sea should be undertaken, and that the work should be under the immediate control of the U. S. Weather Bureau.

There have been several important and careful researches made regarding the probable law of evaporation from small pans, with the view of connecting the amount of water delivered by a pan to that given off by a lake or large body of water in the same climatic conditions. It is much to be desired that the law shall so be expressed that from the given meteorological data of a locality the corresponding amount of the loss of water in a basin of any size can be computed. Unfortunately the results of these researches are by no means in agreement.

In view of the fact that an expensive campaign is being planned at the Salton Sea, to extend over several years, it seemed prudent to attempt to gain some better ideas regarding the physical problems involved before beginning the work in the desert.

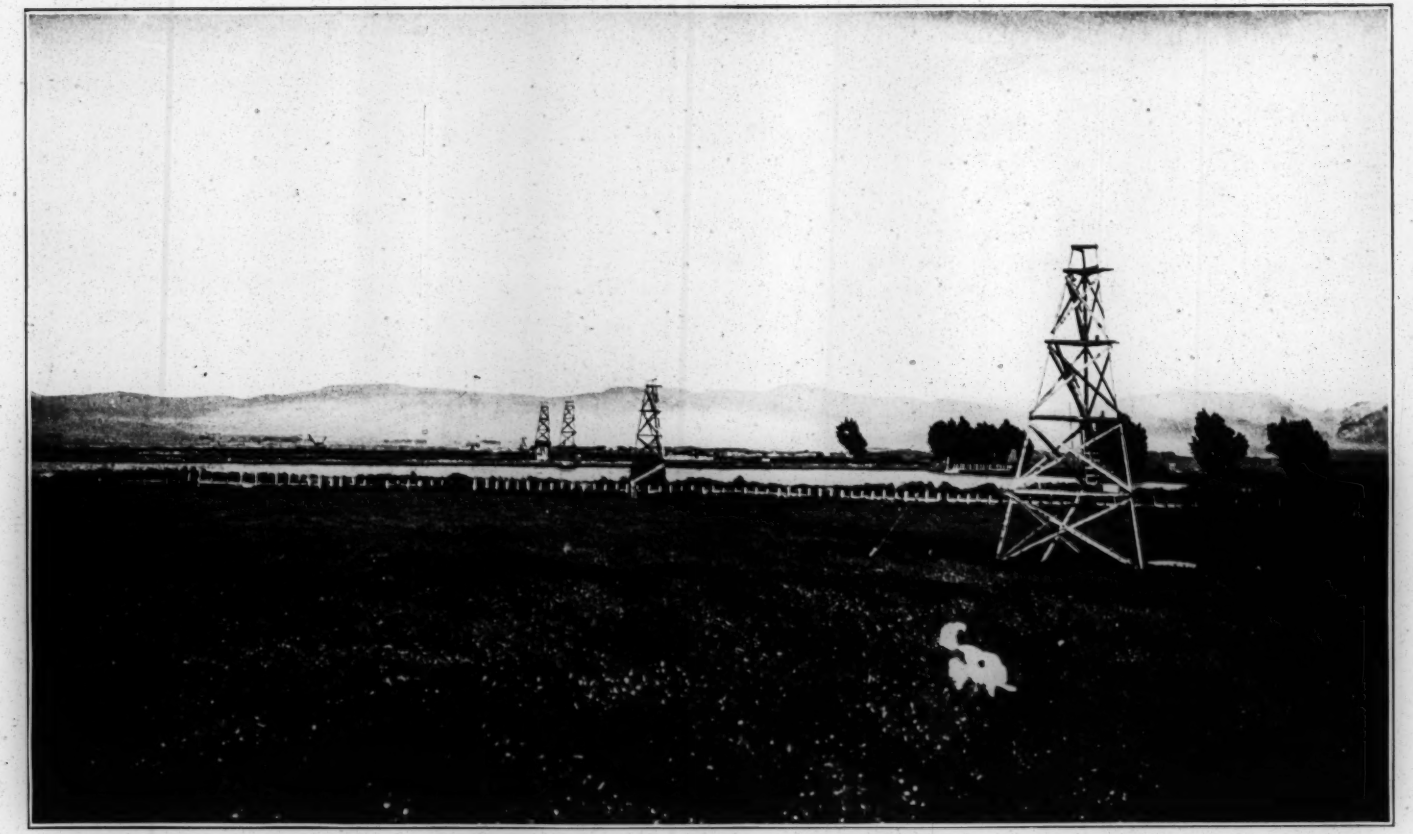
THE STATION AT RENO, NEVADA

After consideration it was decided to set up at Reno, Nevada, a temporary experiment station, planned to bring out the causes of the disagreements. In summer the dryness of the climate at Reno is about the same as at the Salton Sea, and the amount of evaporation from a small pan is nearly the same in amount, nearly 8 feet per year; but the discomfort of working in the open is not nearly so great, on account of its elevation, 4,500 feet above sea-level. Our experience showed us that Reno possesses an unusually agreeable summer climate, with cool nights, not very hot days, and plenty of wind from the mountains to keep up a very pleasant circulation of the air, especially in the afternoons.

We set up five towers, 40 feet high, by August 1, 1907, and continued regular observations till September 15, by which time we had secured all the records needed for our preliminary studies, some 35,000 observations, including 100,000 readings of our instruments. There were 29 evaporating pans placed in position, five 6-foot pans in the water or on the ground near the base of the towers, and twenty-four 2-foot pans on the stagings above the surface. The records were taken every 3 hours during the day, from 5 a. m. to 8 p. m., and readings were made at 1 o'clock, just after midnight. These included the temperatures of the water surface, of the air at half an inch above the water, and of the air at two feet above the water of each pan. The vapor tensions, dew-points, and the amount of water evaporated were also on the program. The wind velocity at different heights, from the bottom to the top of the towers, was observed, and some new Pische evaporimeters were employed, with the purpose of ultimately substituting them for the large evaporation pans.

The serious trouble with all this class of meteorological work is that there is no suitable self-registering apparatus for recording the wet-bulb thermometers or of getting the vapor contents of the air continuously. The consequence is that we must read the instruments many times daily, in order to obtain any correct knowledge of the variations of all these elements with the heating and cooling of the atmosphere in the course of the day,

XUM



THE FIVE TOWERS USED IN THE EVAPORATION EXPERIMENTS, RENO RESERVOIR

The pans may be discerned in the tower on the right. No. 1 is the distant tower and No. 5 the nearest tower, situated in an alfalfa field. The maximum evaporation was at the top of the towers in the lake, but was just as rapid at the bottom of tower No. 1 in a dry field and nearly as vigorous within 10 feet of the ground at tower No. 5 in the alfalfa field.

and at present there is no way to avoid this labor and expense. The physical exertion of climbing towers, carrying a basket of instruments along, making readings all day, was not inconsiderable, as it took from forty minutes to one hour to do the work on a single tower. There were five towers to attend to, and this had to be repeated seven times every day. We had the good fortune to incur no accidents of a personal nature, though several thermometers were broken in the operations.

The wind during the afternoon and evening often reached 40 miles an hour, and even 50 miles per hour, and on the top of the towers it was no little task to guard the delicate instruments against injury in the violent gusts. The Sierra Nevada mountains, 10,000 to 12,000 feet high, poured down into the Reno Valley a powerful current of cool air every day with wonderful regularity, and this caused the strong winds to prevail.

INTERESTING RESULTS

We succeeded in keeping up the current reductions of the observations to an advanced stage, and so gained an idea of our results before leaving Reno, the 18th of September. They were such as to show clearly enough the source of the discrepancies that have been mentioned. For example, it was soon seen that the evaporation from the pans on the top of the towers was from two to three times as much as at the foot of the towers, in or near the water, and that there is a regular progression from pan to pan. On the other hand, in the dry field where tower No. 1 was located there is no such important difference, the evaporation being practically the same all the way up the tower. At tower No. 5, in the alfalfa field, where the ground was wet from irrigation, we found that the retardation of evaporation was confined to 10 or 15 feet from the ground.

It became clear enough that the reservoir, which is about 1,000 feet long, covers itself with a sheet of invisible vapor about 30 feet thick, and that this vapor acts like a blanket upon the fresh evaporation rising from the water. During the process of evaporation there are two principal stages: First, the water must turn into vapor, and the amount differs according to the temperature. Thus, for 0° centigrade 1 cubic centimeter becomes 211,000 cubic centimeters of vapor; at 100° centigrade it becomes 1,658 cubic centimeters of vapor. Second, these columns of fresh vapor must stream off into the air by diffusion and mixture, and the capacity of the air to receive it depends upon its own temperature and dew-point, which determine its vapor contents. If the air is dry and the difference between the dry-air temperature and dew-point is great, there will be rapid evaporation, but if small the evaporation will be slow. The wind is an important factor, because it brings new masses of air, not so much saturated, over the water surface, and thus keeps the superposed air more ready to receive the newly evaporated vapor. There are at least five factors to take into the account:

1. The diffusion factor—a function of the height above the surface of the water.

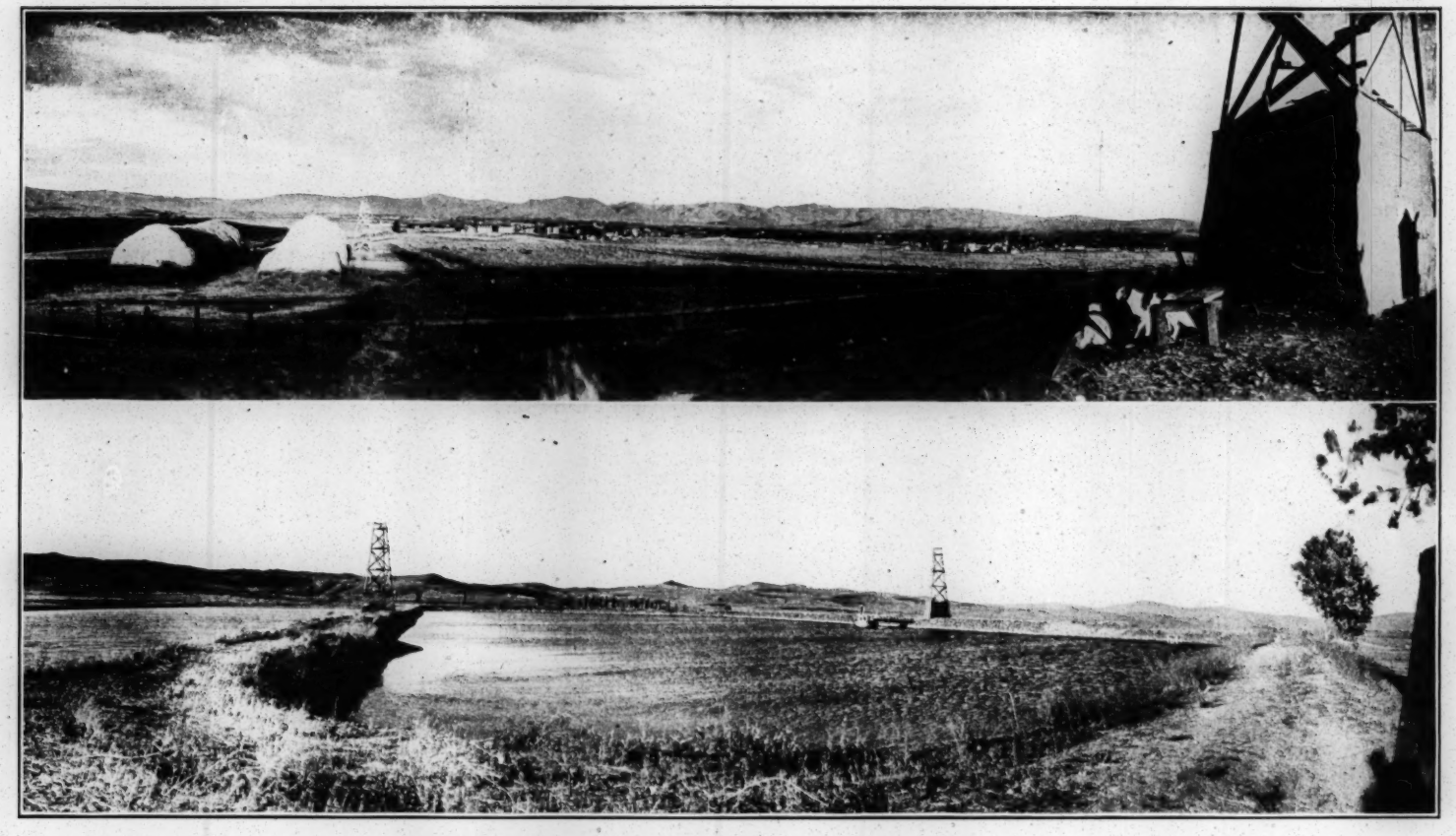
2. The temperature of the water and its capacity to deliver vapor—a function of its vapor pressure.

3. The capacity of the air to receive vapor—a function of the difference between the dry air temperature and the dew-point.

4. The velocity of the wind, the function being the square of the velocity.

5. The wind coefficient, being a function of the height above the ground.

A small pan in the open air, away from a sheet of water, evaporates faster than the same pan in like conditions located within the blanket of vapor lying over a lake, because these factors operate together differently. Hence it is evident that the location of the experimental pan relative to the water surface of a lake must be fully taken into the account. The many pans at Reno gave differing results, grading up and down the towers, and from the center of the reservoir to the distant dry fields, in such a way as



SCENES NEAR RENO, AND THE EXPERIMENTAL TOWERS

The city of Reno is seen from the reservoir on the right; the University of the State of Nevada in the middle, and the town of Sparks in the distance, near tower No. 1; hay ricks from irrigated fields, the water coming from the Truckee River and Lake Tahoe, in the Sierra Nevada Mountains.

The double reservoir. The evaporation was more than twice as rapid at the upper pans as at the water surface. This is due to a blanket of vapor about 30 feet thick which retards the evaporation in the layers of air near the water. In this way nature conserves its waters from too rapid loss by evaporation. Photos by J. E. Church, Jr.

to leave no question of these facts. Previous researches have not taken sufficient account of the locality of the small pans in deriving their formulas, and they have been discordant as a consequence.

The preliminary discussions of the data, made since our return to Washington, show that we must depart from the common Dalton Law in at least four important particulars, and we shall proceed to test the new formula as fully as possible within the next few years.

It is our purpose to erect two or three towers at the Salton Sea, one high tower on a small island about four miles from the southern edge of the sea, to get some idea of the behavior of the great vapor blanket lying over that large water area. We must know its depth and how it acts over a large body of water, as compared with the small Reno reservoir. There will be two smaller towers in the sea, one about one mile from the Salt Creek trestle and projecting 20 feet from the surface, and another in 50 feet of water and flush with the surface. As the waters recede under evaporation, in a few years these sea towers will gradually become land towers, and this will enable us to study the working of the blanket from the middle of the sea into the country—that is, for large and for small lakes—in the course of a few years. It is purposed to invent, if possible, suitable apparatus for self-registering the evaporation and for recording the vapor contents of the atmosphere.

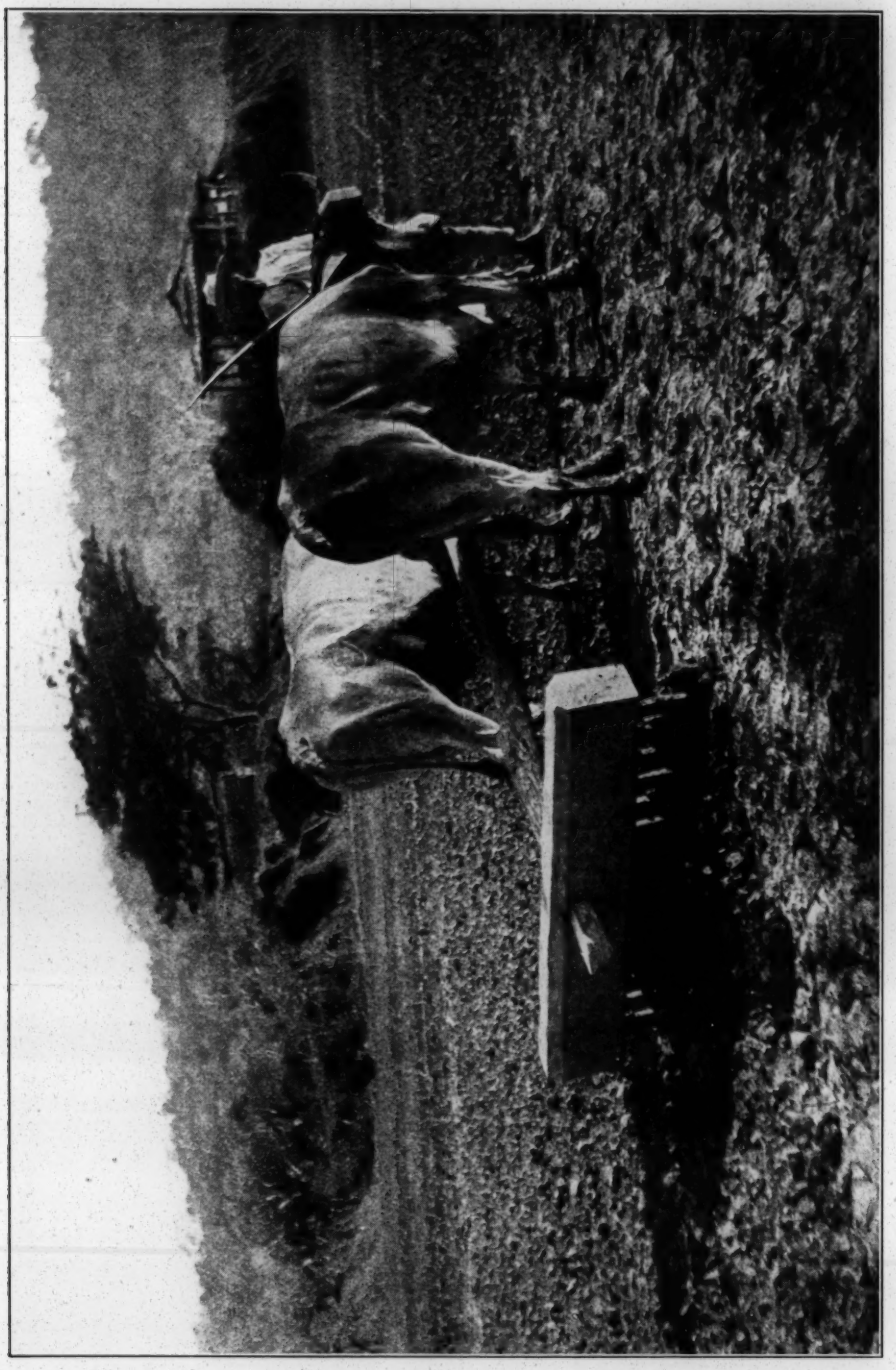
There are, however, numerous and serious difficulties to be overcome in the carrying on the work at the Salton Sea, and not the least is the hardship of enduring the high temperatures of the summer as well as the loneliness of the isolated life that must be experienced by the observers. The officials of the Southern Pacific Railroad—Mr R. H. Ingram, the general superintendent of the Southern California division, and Mr A. D'Heur, the chief engineer—have courteously agreed to coöperate with the U. S. Weather Bureau in the construction and maintenance of the piers, towers, and houses needed for the investigations.

I was assisted at Reno, Nevada, by Mr H. L. Heiskell of Washington, D. C., Mr Geren, Mr Robeson of Reno, Professors Minor and Church of the University, by Messrs Pearson, Steffin, Beebe, Potthoff, students, and by many citizens of the city of Reno, to all of whom the Weather Bureau is greatly indebted.

METHODS OF OBTAINING SALT IN COSTA RICA

THE following series of illustrations, showing the methods of obtaining salt on the Pacific coast of Costa Rica, were taken by Professor Y. Fid Tristan of San José. Professor Tristan is a member of the National Geographic Society who lives in Central America, and sends the pictures to its Magazine that all the members of the Society may see this quaint method of getting salt.

There are only a few miles of railway in Costa Rica. Transportation is therefore expensive, but labor is cheap. While the salt obtained in this primitive manner is coarse, it answers most of the requirements of the people. Costa Rica is one of the most interesting sections of the Americas. The proportion of its white population is large for a Latin American country. Public instruction is free and compulsory and the Costa Ricans are among the most cultured of the American peoples.

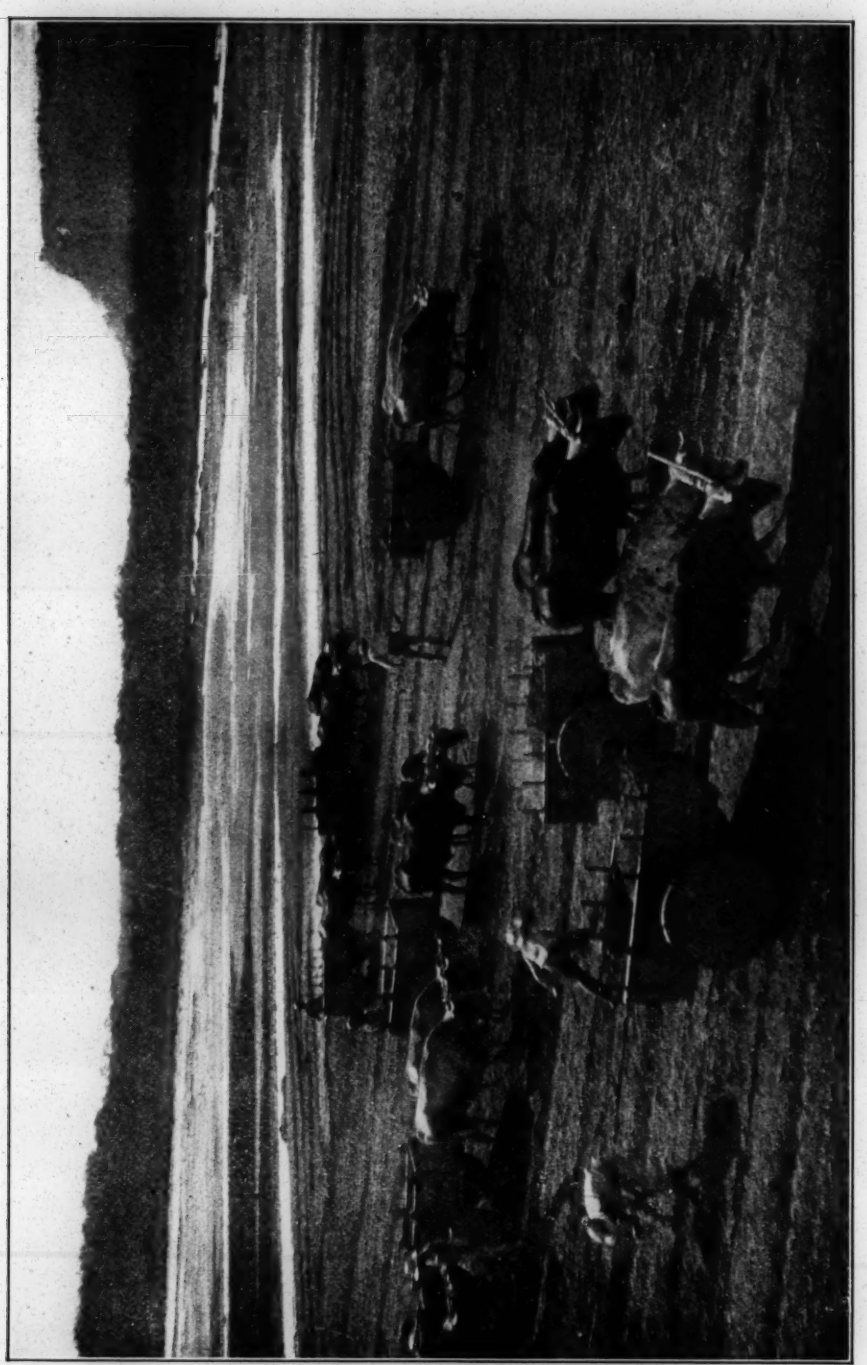


OBTAINING SALT AT CALDERA, COSTA RICA

The places in which salt is made are low and flat lands which are flooded at high tide. After withdrawal of the water, when the soil is left dry, a queer implement which looks like an enormous wooden comb drawn by oxen is dragged over the whole patch of land. Photos by Prof. Y. Fid Tristan.

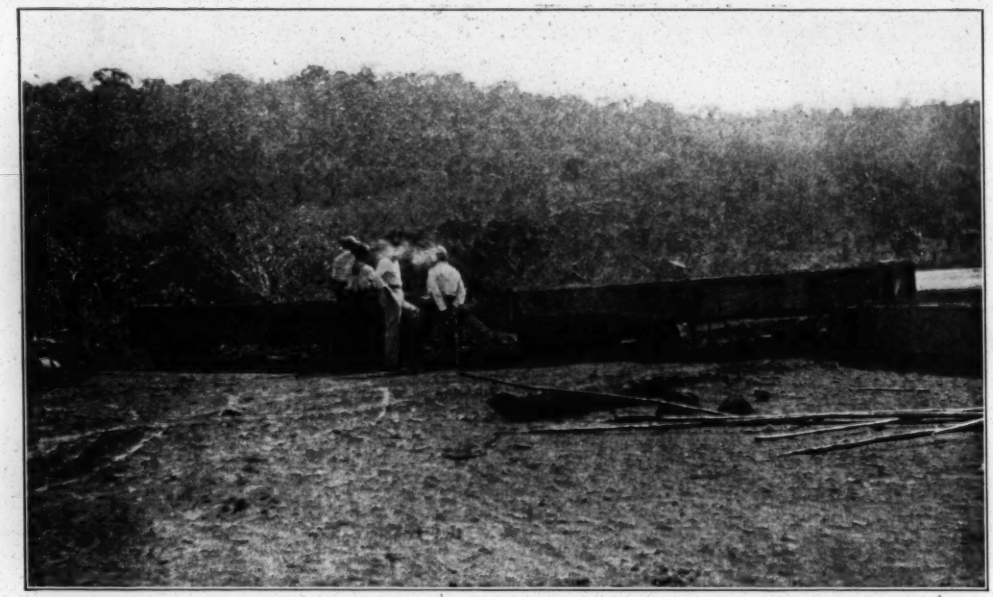
PROVIDED WITH WOODEN SPADES THE PEONES GATHER THE SALTED EARTH INTO LONG, NARROW HEAPS

THE HEAPS THUS MADE AND THE LOW WATER AT THE DISTANCE



COLLECTING THE SALTED EARTH

While the oxen are slowly progressing the *peones* rapidly load into the carts the salted earth. The contents of all carts are unloaded so as to make a single heap



FILTERING OUT THE SALT

The salted earth is unloaded into two wooden tanks, in the bottom of which a layer of straw and sand has been placed. Salt water is poured over the earth and filters through the straw and sand. The saturated water is collected into another tank buried under those which are in sight. To ascertain the density of the solution a new laid egg is introduced into it. The operation is concluded when the primitive areometer is nearly but not completely submerged.

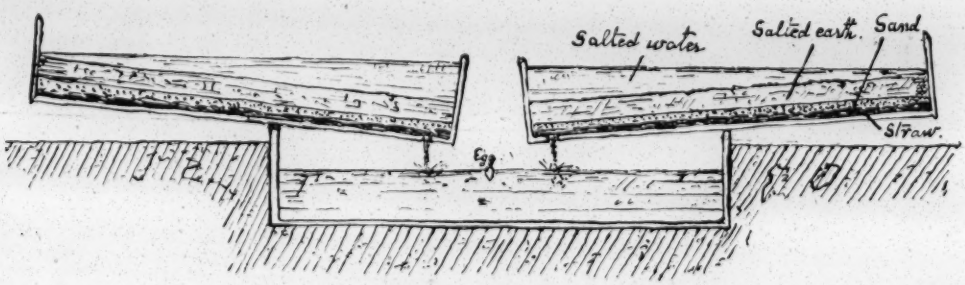
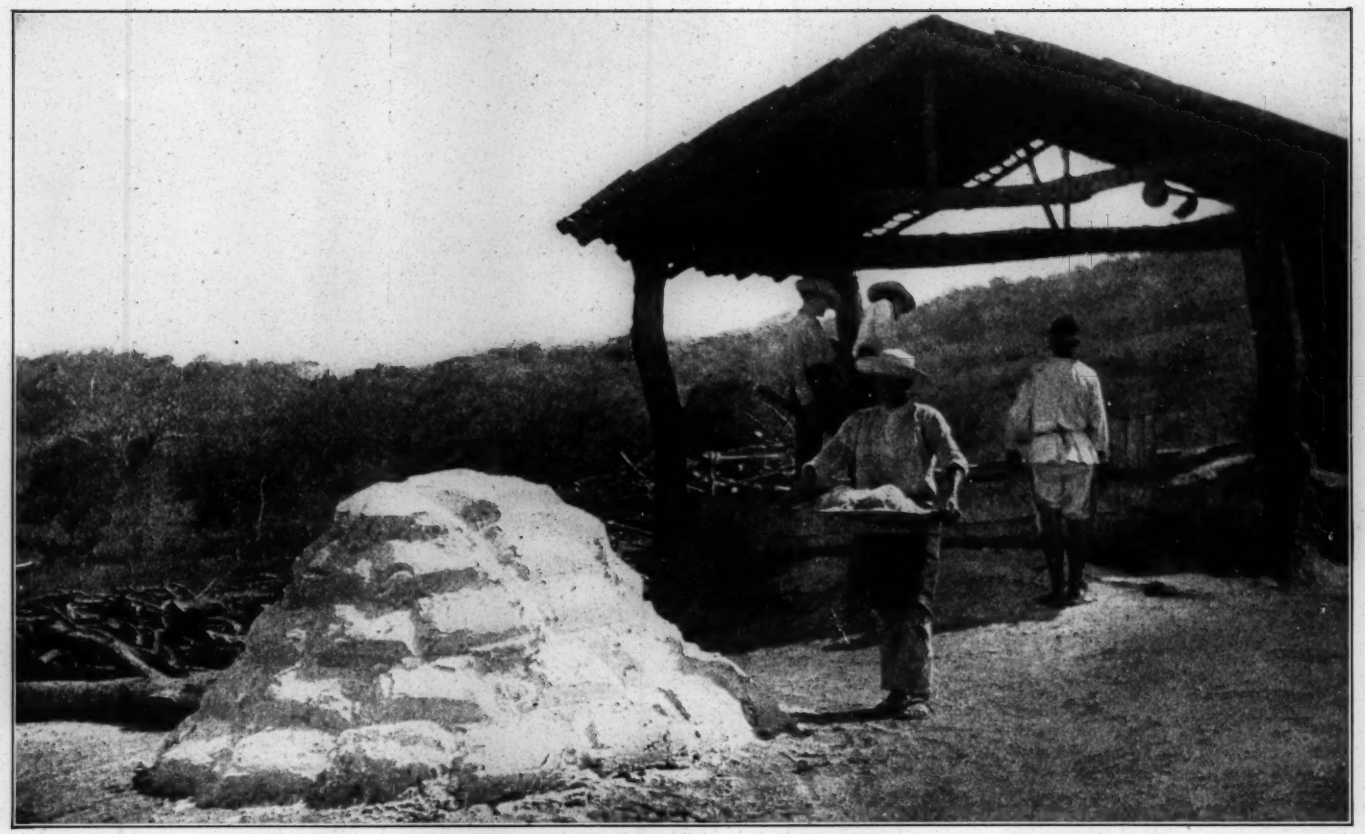
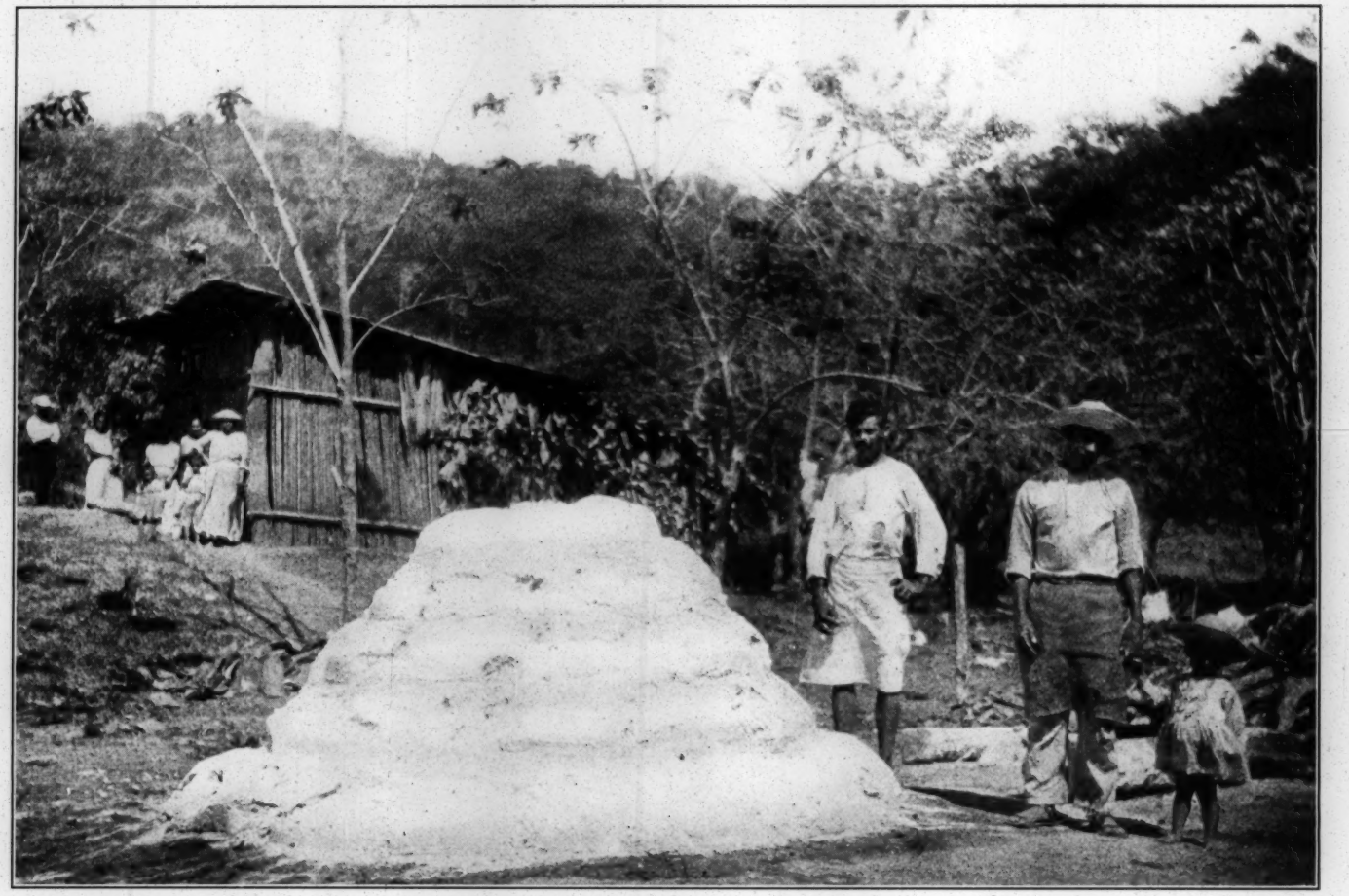


DIAGRAM TO EXPLAIN THE FILTER TANKS



VAPORIZING THE SALT SOLUTION

The saturated solution is brought to the vaporating pans where it is converted into a solid mass of impure salt. This is heaped into a large deposit. Wooden dishes are used to carry the salt from the pan to the heap



WEATHERING THE SALT

Here the tropical climate takes a share in the operation. Owing to the dampness of air the various delinquescent salts, which are found together with table salt in sea water, are dissolved and run out in a stream from the heap. The salt always remains impure. Photos by Prof. Y. Fid Tristan.

DR BELL'S MAN-LIFTING KITE

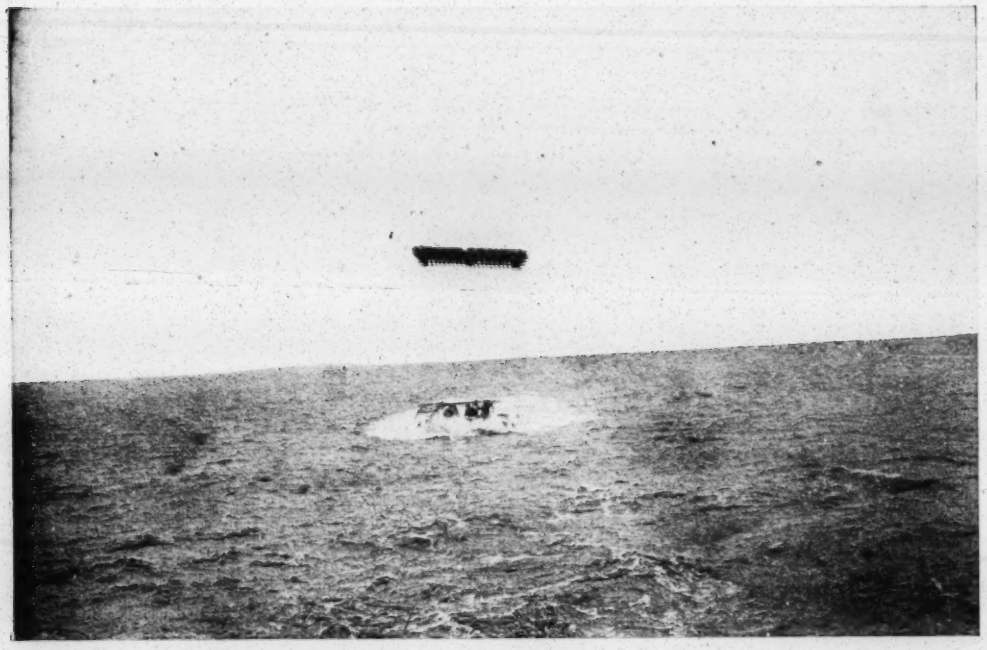
THROUGH the courtesy of Dr Alexander Graham Bell, the NATIONAL GEOGRAPHIC MAGAZINE is enabled to print the following series of illustrations of his experiments with his gigantic man-lifting kite, the Cygnet. This kite was sent up in December, 1907, both with and without a man. The pictures on pages 42-44 show it aloft, carrying no weight, while those on pages 49-52 illustrate the flight when Lieutenant Selfridge, of the United States Army, ascended to a height of 168 feet and remained in the air for over seven minutes.

While Dr Bell's ultimate object is to secure a flying machine that will support itself in the air at a moderate rate of speed,* the experiments with the Cygnet have been mainly studies in stability. The wonderful steadiness of this form of structure is shown by the pictures and especially by the fact that the Cygnet descended from 168 feet to the water so slowly and evenly that the man aboard did not realize he was dropping until he found the kite in the water. The kite flew as easily with Lieutenant Selfridge aboard as it had on the previous trial with no load, and could undoubtedly have borne a weight several times as great as that of one man. Owing to the severity of the winter in Baddeck, Cape Breton, Nova Scotia, where these experiments are being conducted, it has been necessary to postpone further flights until the spring, when the work will be resumed.

Dr Bell's next step will be to put a powerful light motor on a modified form of the Cygnet.

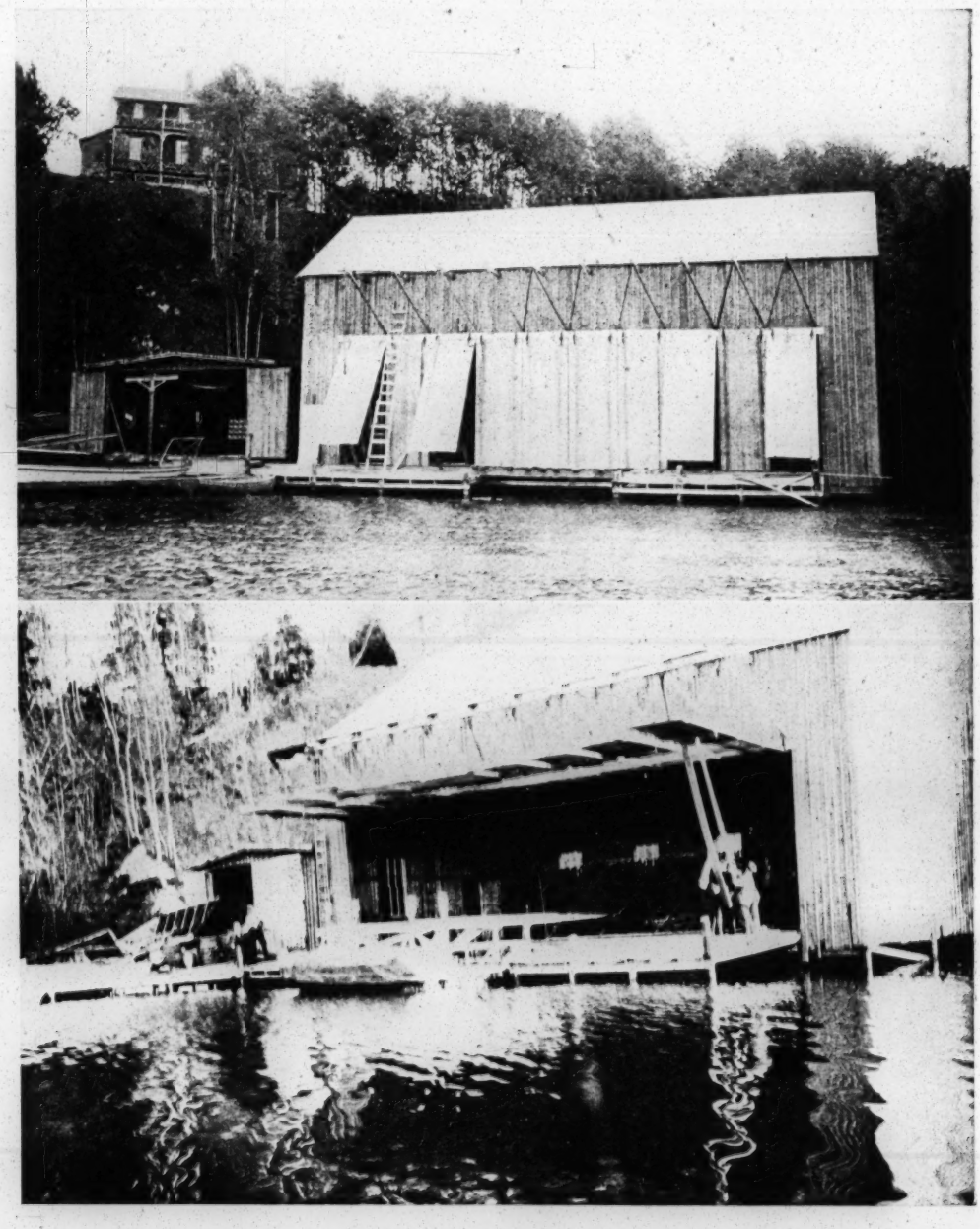
The photographs were taken by Mr J. A. Douglas McCurdy.

* See "Aërial Locomotion, with a few notes of progress in the construction of the Aërodrome." By Dr Alexander Graham Bell, NATIONAL GEOGRAPHIC MAGAZINE, January, 1907.

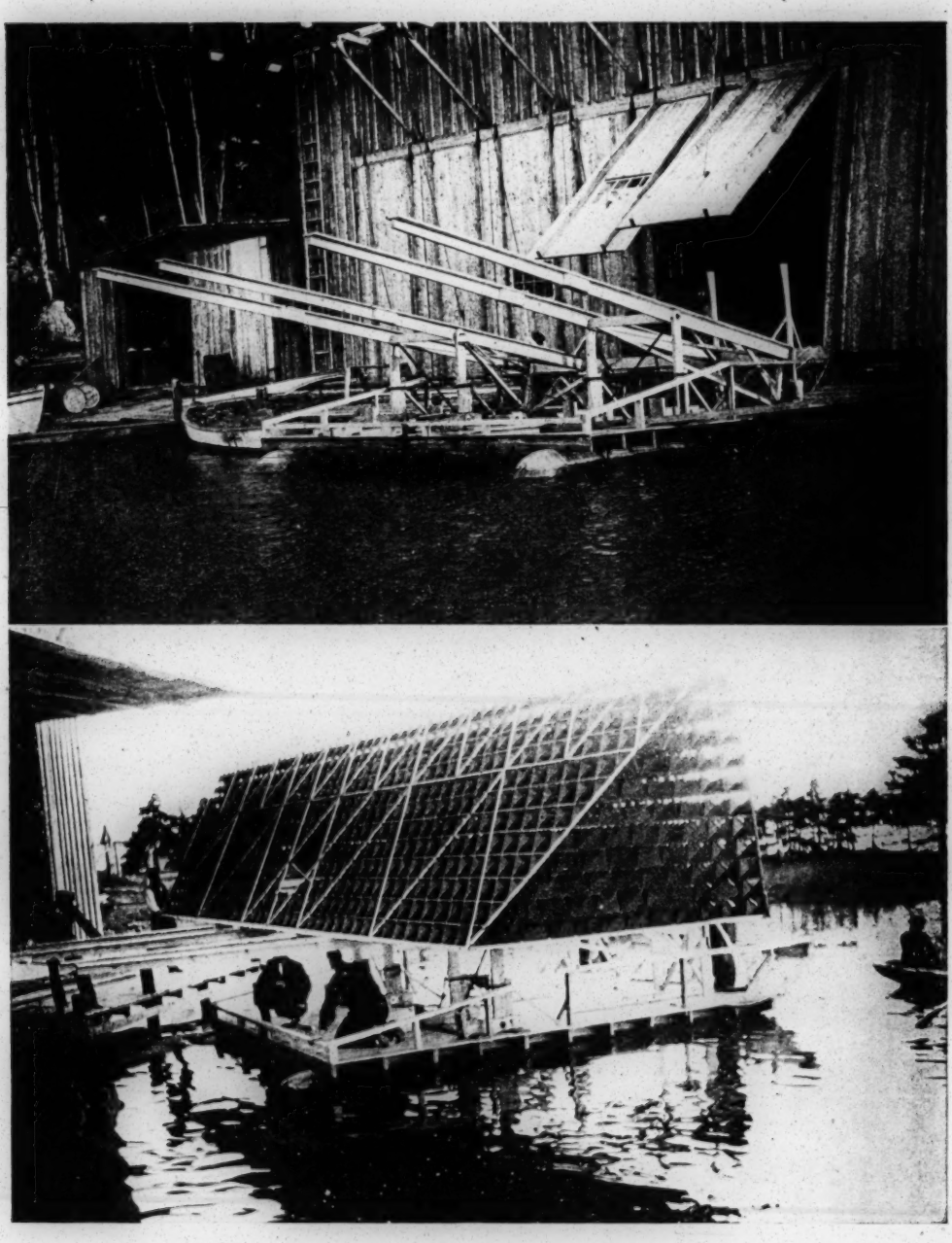


PRACTICE DRILL WITH A SMALL KITE

The water shield in the bow keeps the men comparatively dry



VIEWS OF THE AERODROME SHED IN WHICH THE GIANT MAN-LIFTING KITE, THE CYGNET, IS HOUSED

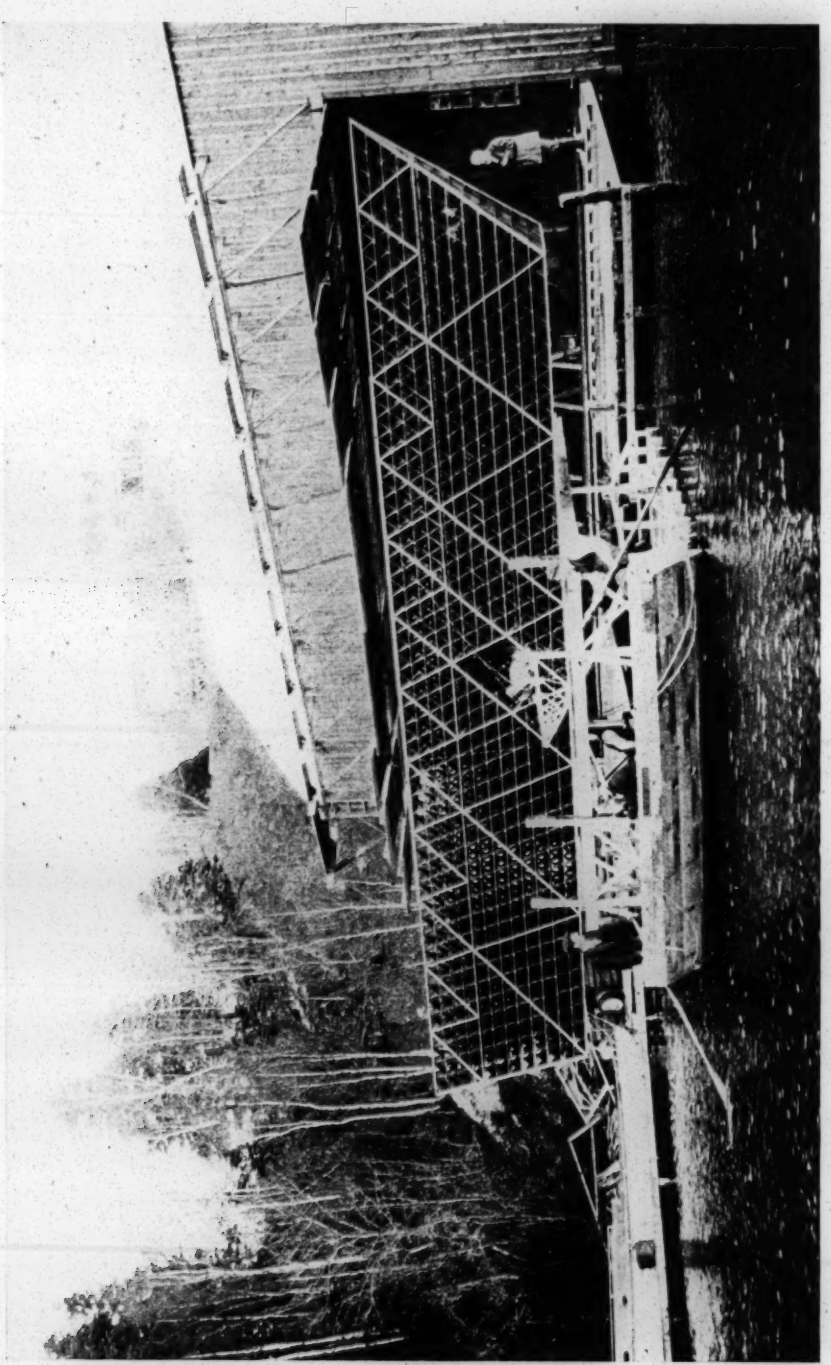


VIEW OF THE AERODROME SHED

Showing the raft with its long tilting arms backed up against the building to receive the giant kite. The Cygnet placed on board the raft

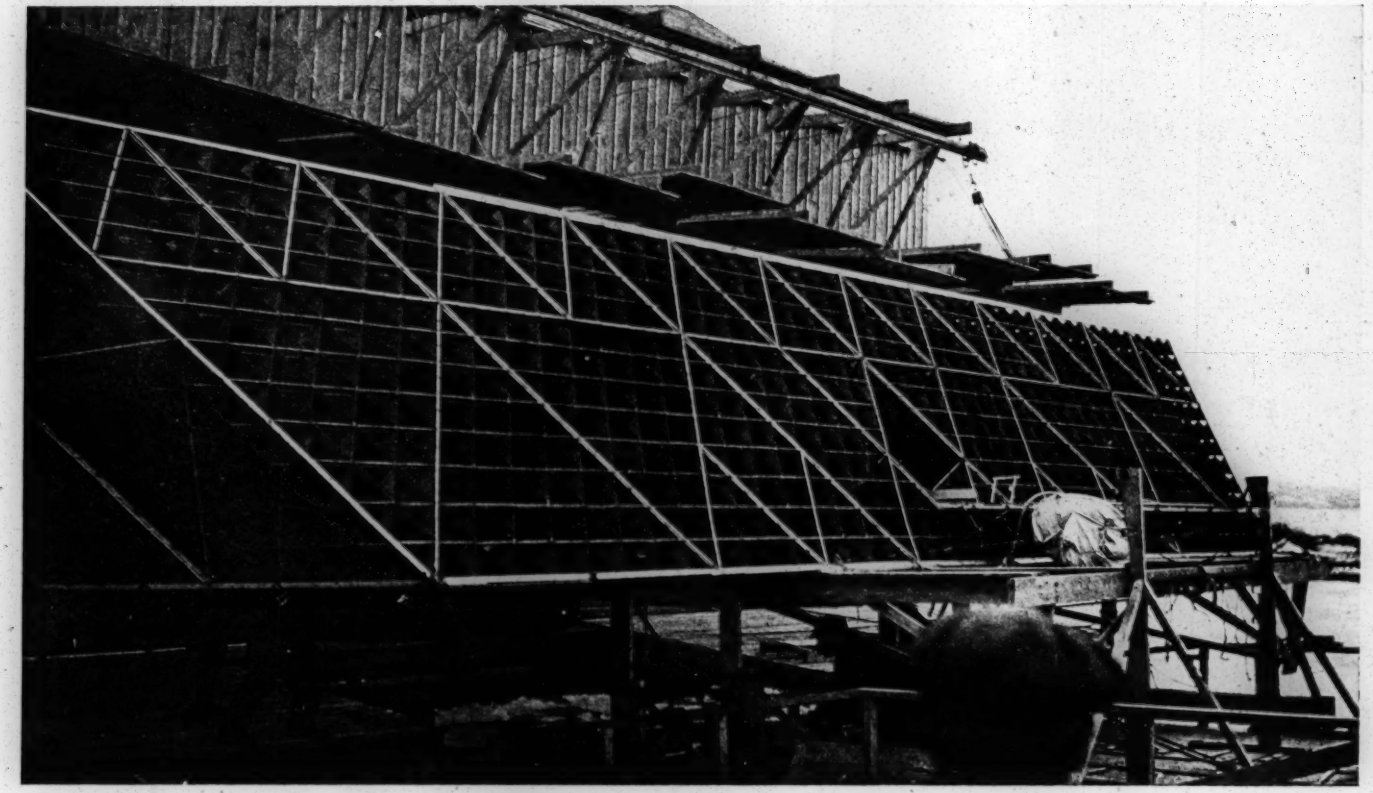
MEMBERS OF THE AERIAL EXPERIMENT ASSOCIATION

Beginning on the left, G. H. Curtiss, of Hammondsport; F. W. Baldwin, C. E., of Toronto; Dr Alexander Graham Bell; Lieutenant Thomas Selfridge, U. S. A., and John A. D. McCurdy, C. E.



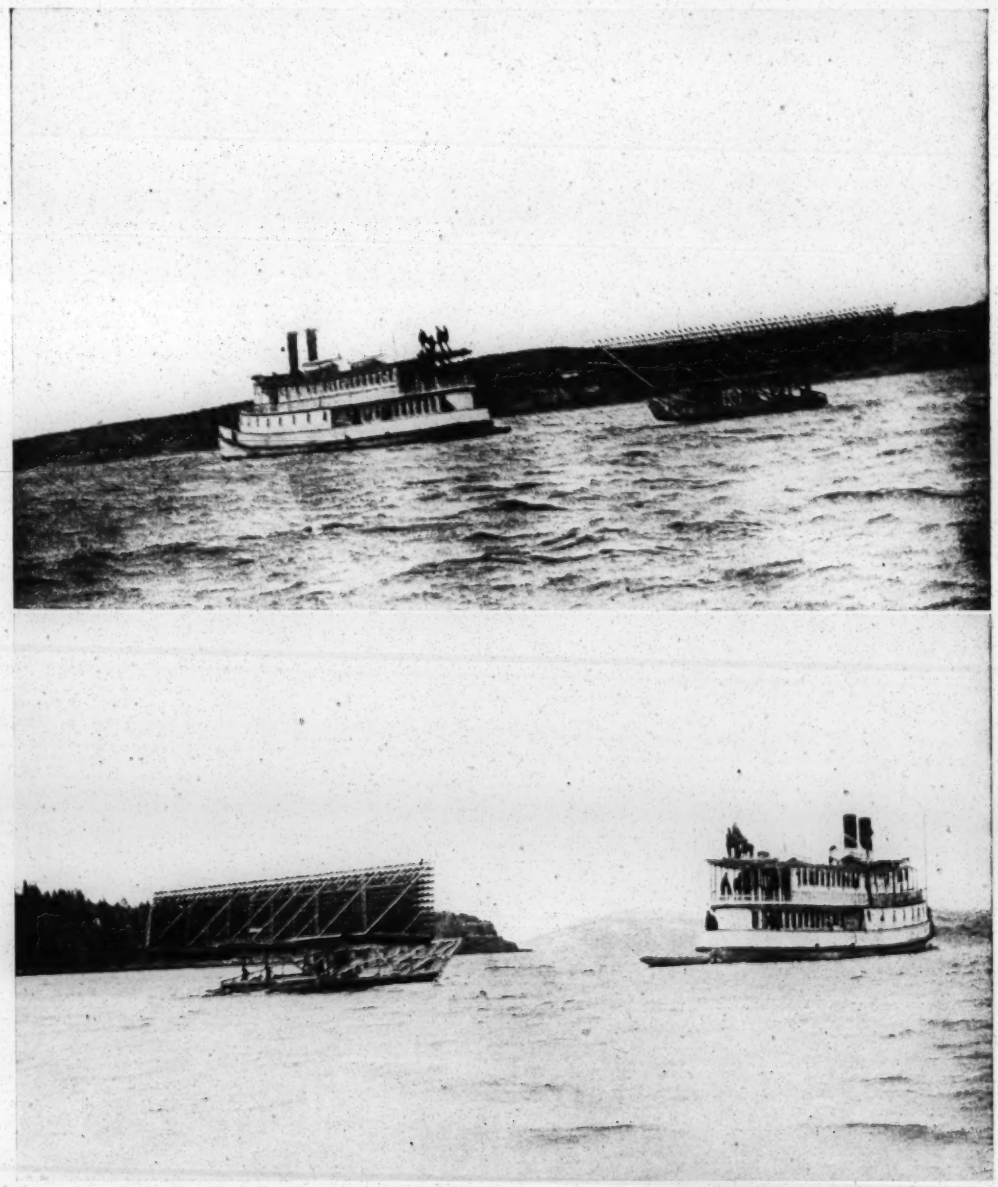
FRONT VIEW OF THE CYGNET, SHOWING THE MANHOLE IN THE CENTER

The dimensions of the kite are: 13 meters from side to side on the top, and 10 meters on the bottom; oblique height, 3 meters; depth from fore to aft at the bottom, 3 meters



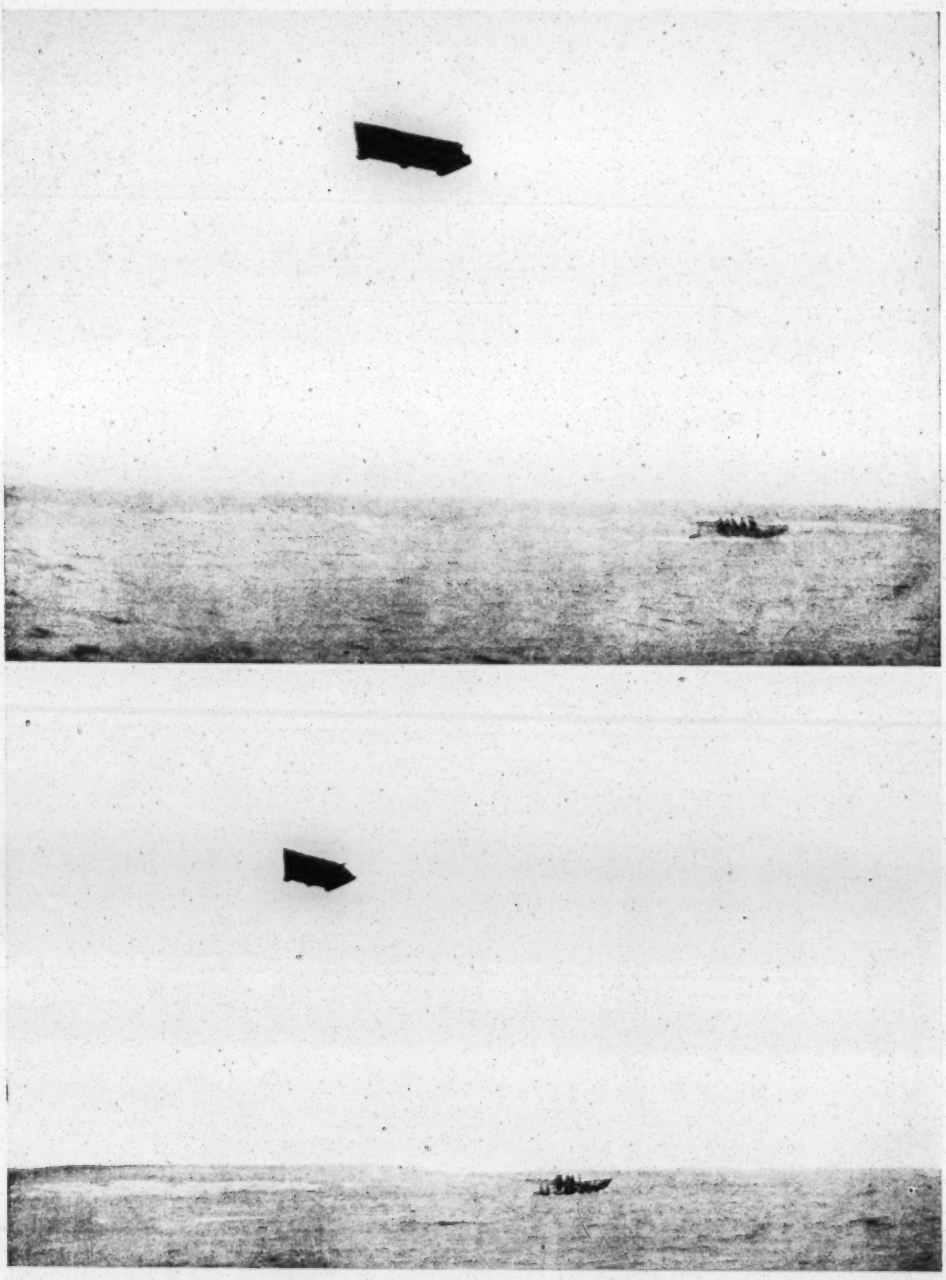
ANOTHER VIEW OF THE GIANT "CYGNET"

The kite proper weighed 85.032 kilograms, and the floats 9.400 kilograms; total, 94.432 kilograms (208 pounds). Flying weight, 510 grams per square meter (oblique). The kite is composed of 3,393 winged cells, having a surface of 183.6461 square meters. The bow was covered below with silk, presenting the same dihedral angle as the cells equivalent to 1 meter. In addition to this the bottoms of the floats gave a horizontal surface of 8 meters, but as the floats undoubtedly blanketed the lowest tiers of cells above them the floats may be counted as dead load, and the whole surface considered as equivalent to 185 meters oblique. The white bag in center is the sea anchor which, when the kite takes the water, keeps the kite headed to the wind. (See page 45.)



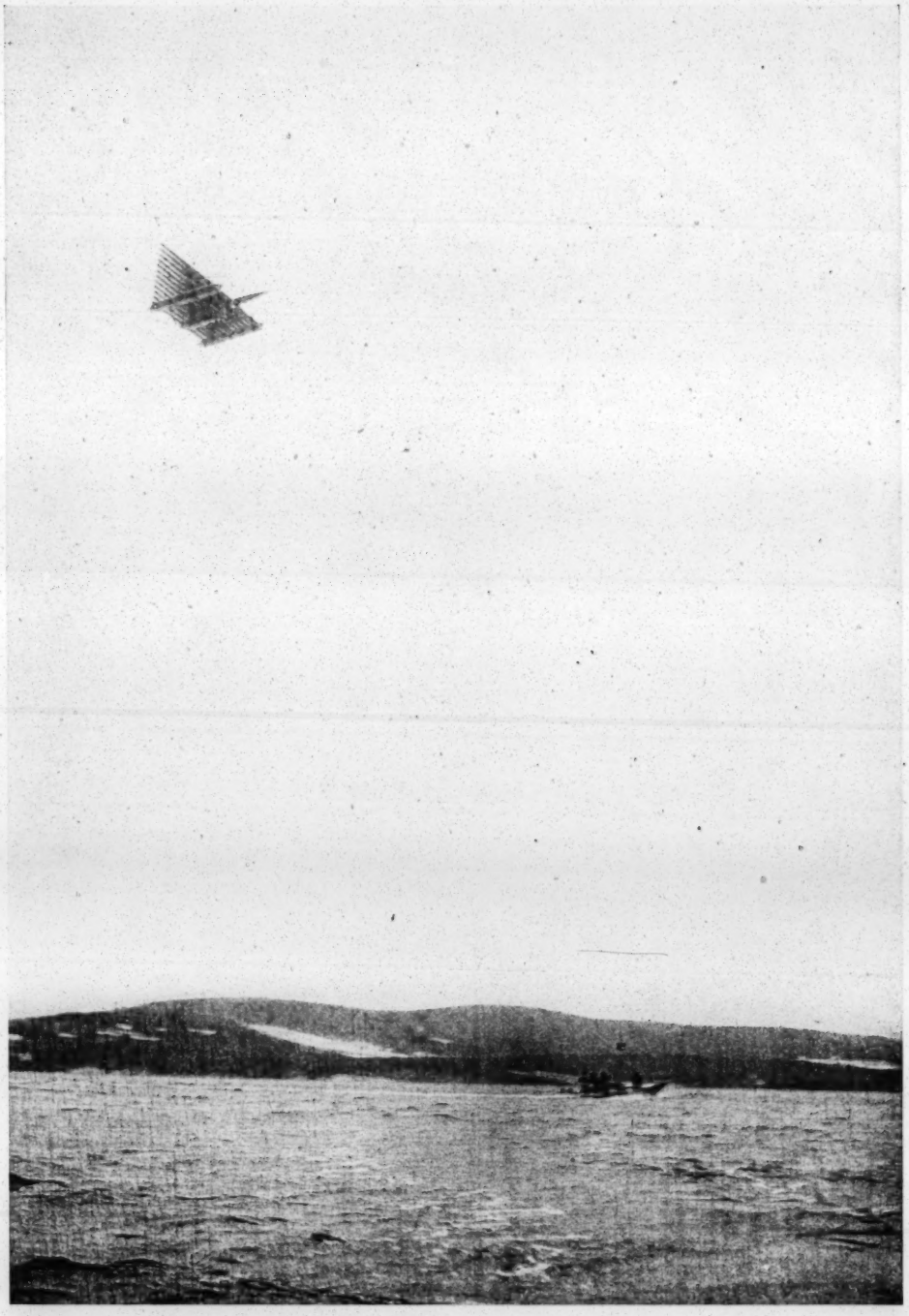
TOWING THE GIANT KITE, PREPARATORY TO SENDING IT ALOFT

When everything is ready for the release, the tilting arms of the raft (see pitcure, p. 37) are raised, and the kite let go



VIEWS OF THE KITE IN THE AIR

Flying in a 30-mile wind. The remarkable stability of the tetrahedral structure in air is illustrated by the pictures. For flying weight see p. 40

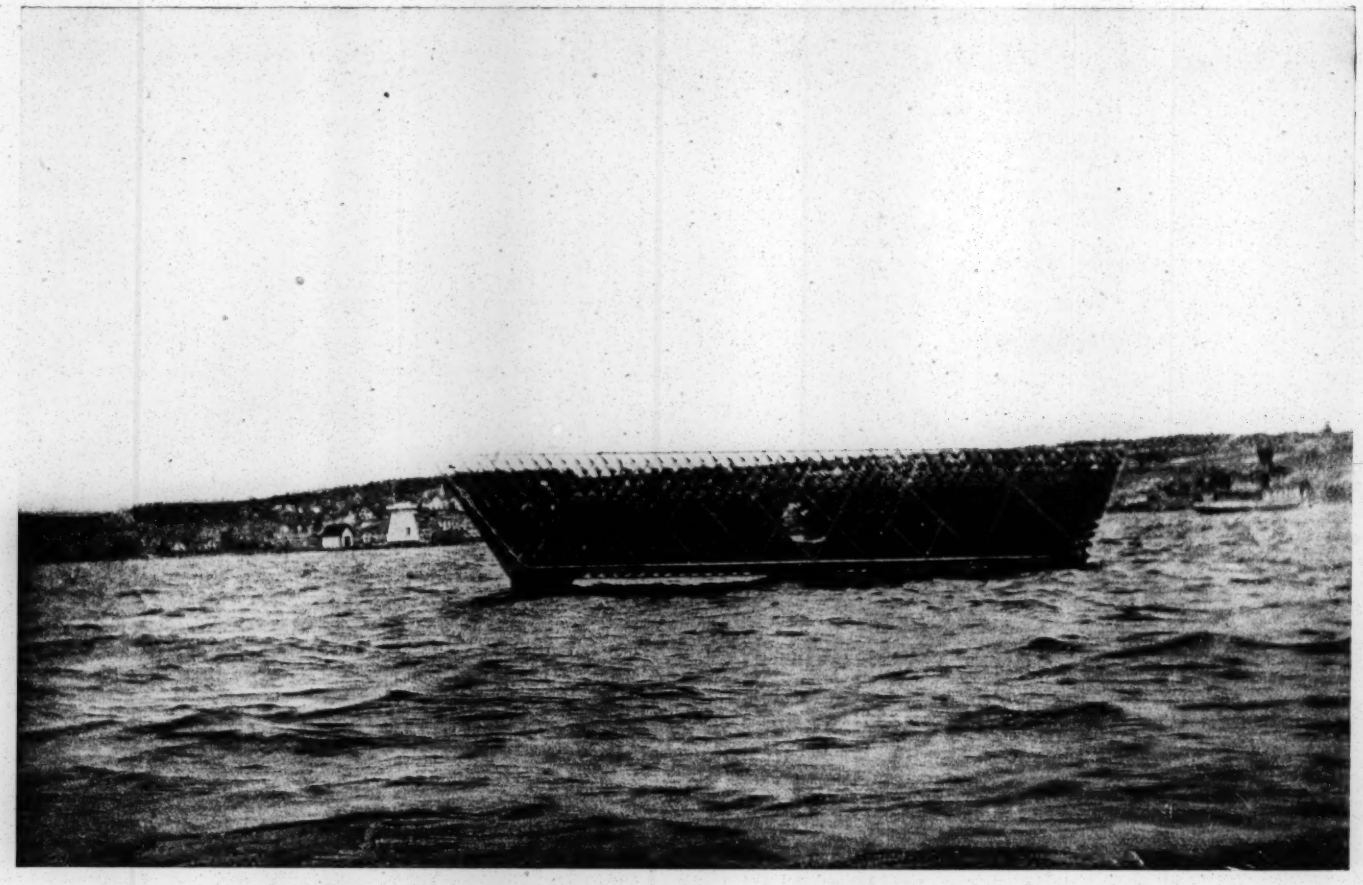


ANOTHER VIEW OF THE KITE ALOFT

The pull on the flying line was greater than could be measured, but considerably exceeded 210 pounds

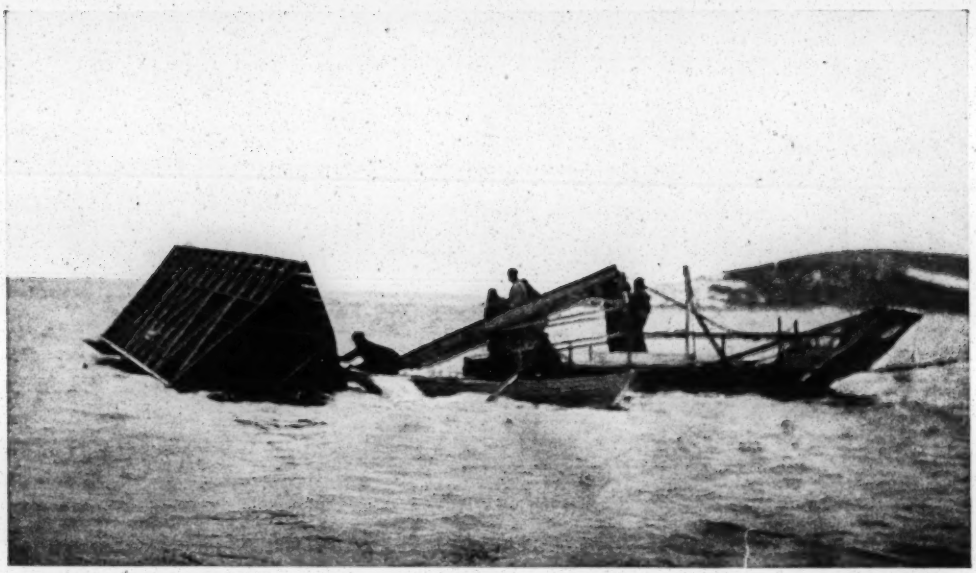
VIEWS OF CYGNET IN AIR

1 and 2. Sending the kite up; bowline slack, flying line tight. 3. Bringing the kite down; bowline tight, flying line slack. The white dot seen on the kite is the sea anchor



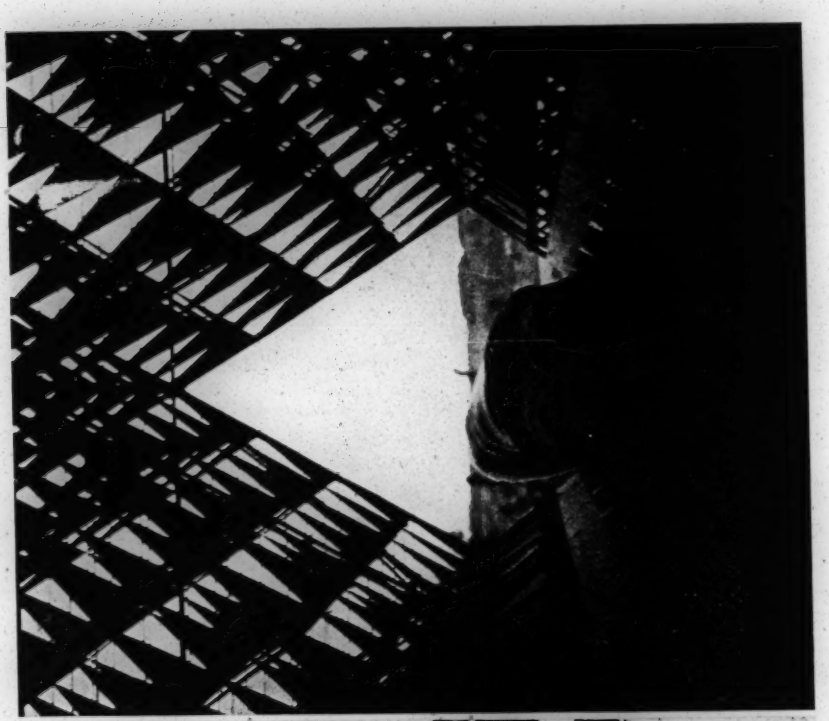
AFTER THE DESCENT—FLOATING ON THE WATER, WAITING TO BE PICKED UP

No effort was made, on the first flight of this kite, to land it on the raft when it descended. Both flying line and bowline were let go and the kite allowed to take care of itself. After release the drag of the lines in the water kept the kite flying at an elevation of about 20 feet above the water. The kite drifted in this way for more than a minute and a half, coming down very slowly and gently until she rested on the surface of the water. The sea anchor (see p. 40) took the water well and held the kite in position, facing the wind, until rescued by a row boat.

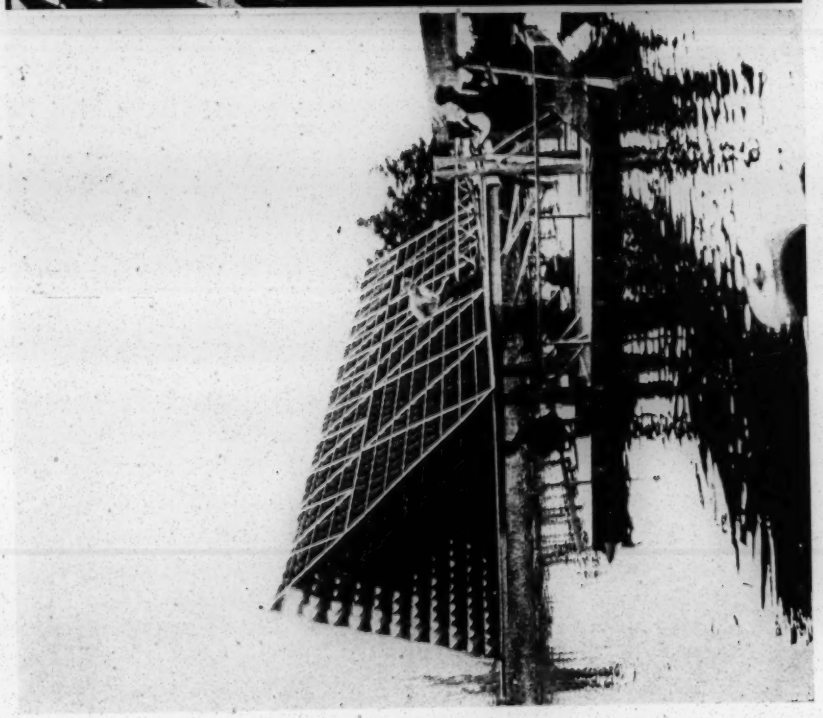


PICKING UP THE CYGNET

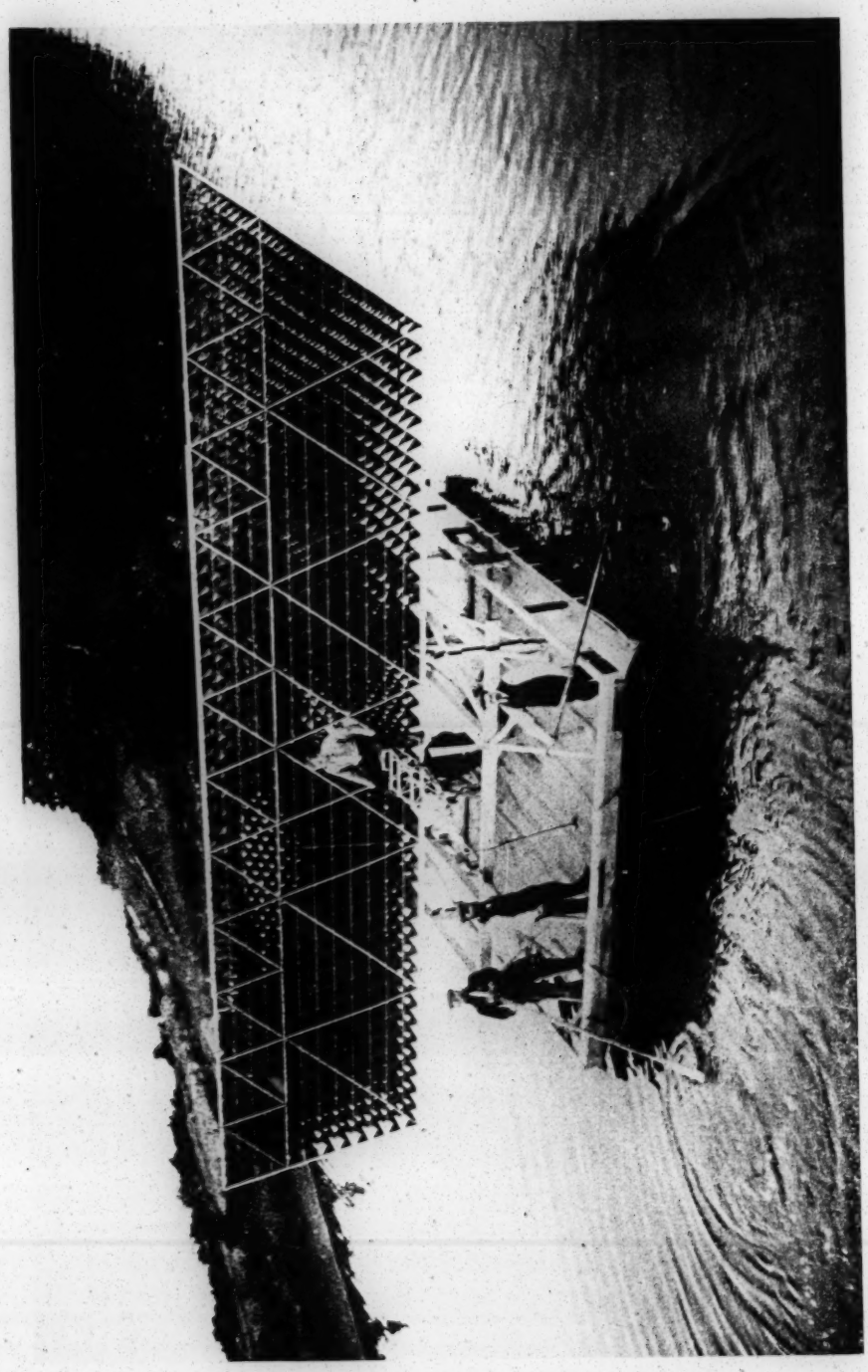
THE CYGNET SAFELY LIFTED ON TO ITS RAFT AND READY TO BE TOWED HOME



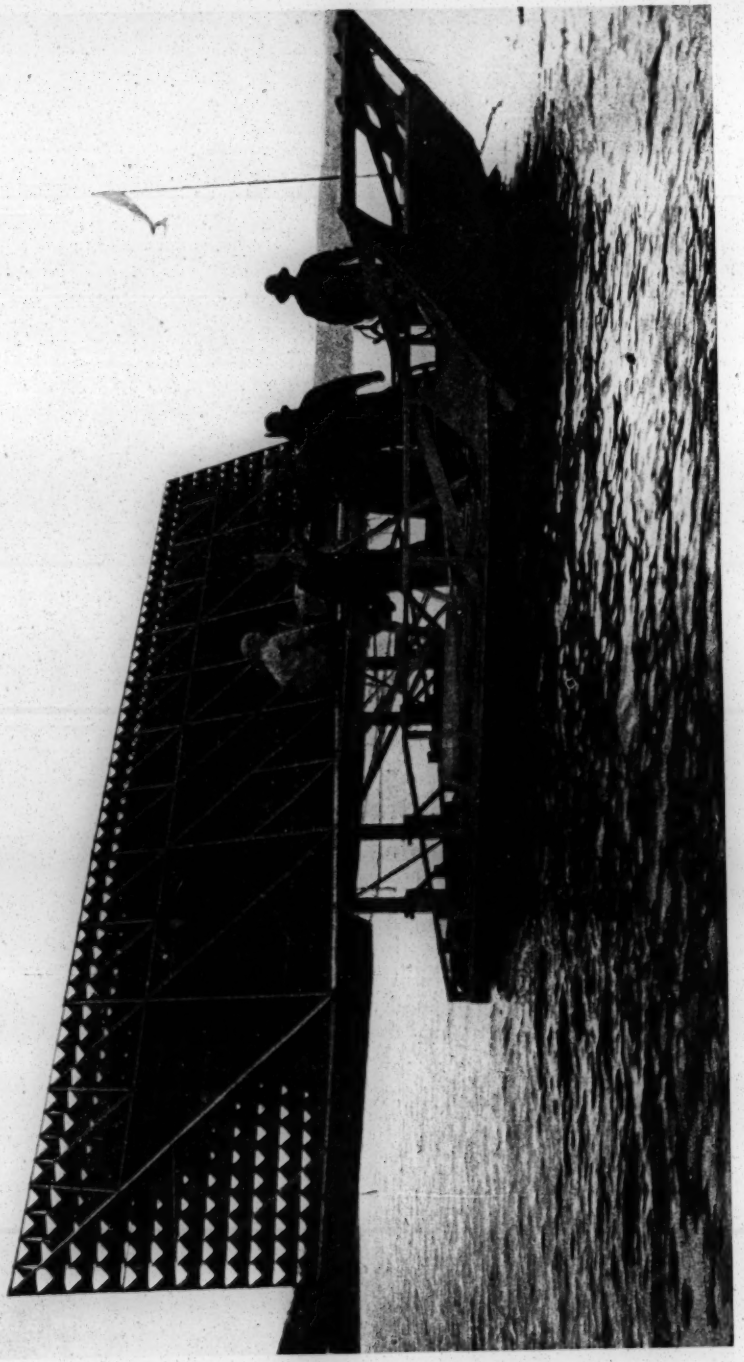
THE MANHOLE



END VIEW OF THE CYGNET

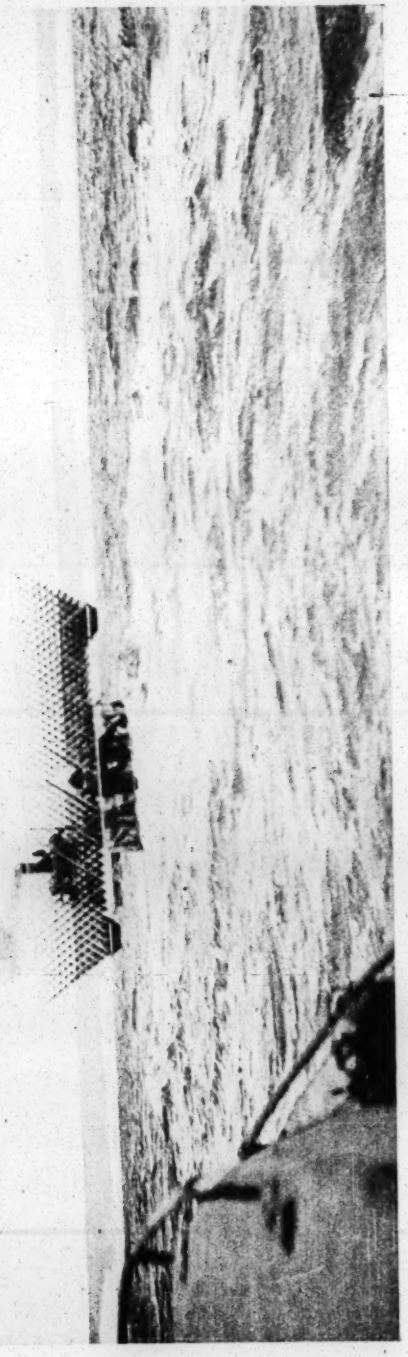


ANOTHER VIEW OF THE CYGNET, SHOWING THE MANHOLE

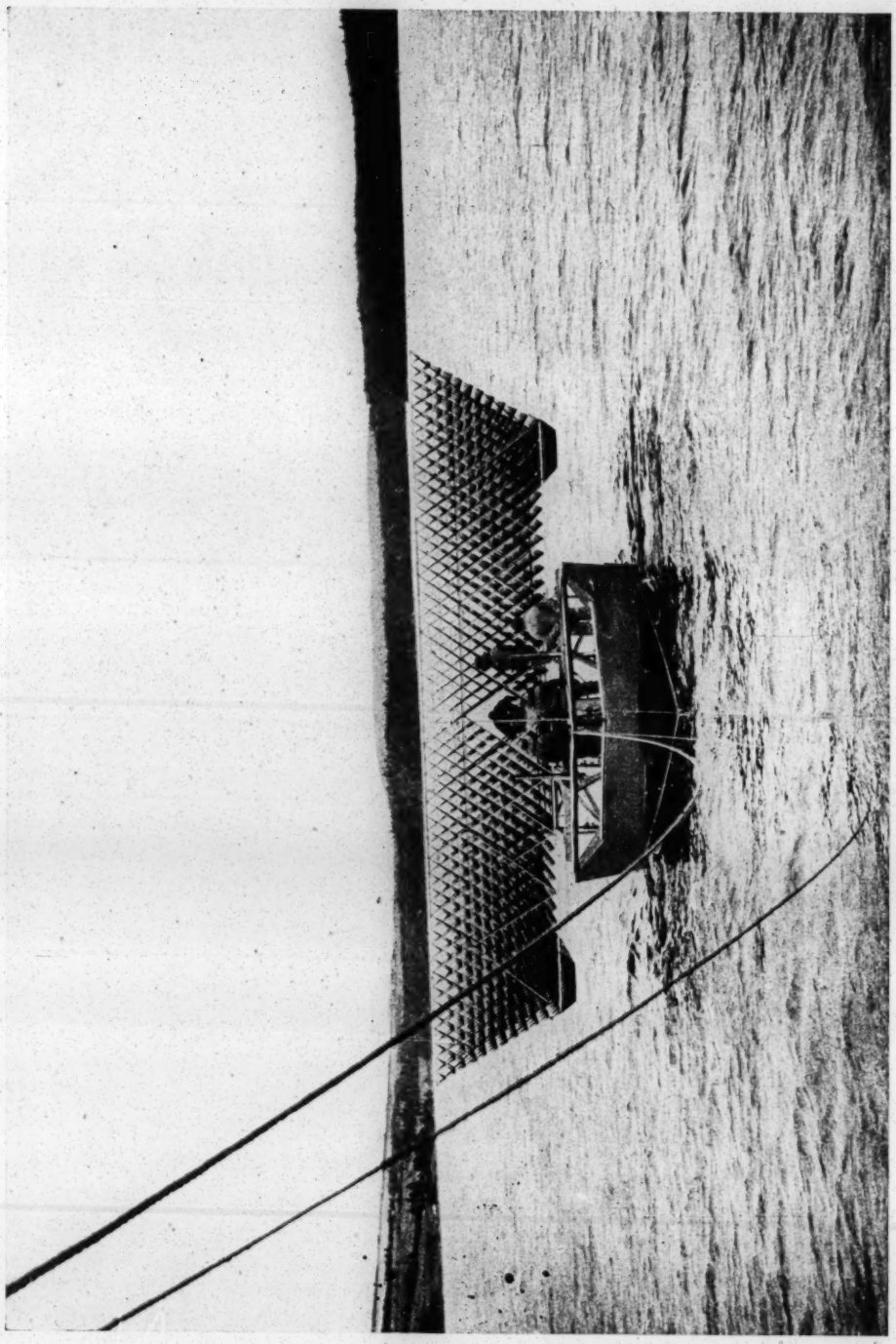


FRONT VIEW OF THE RAFT AND KITE

The high shield at the bow of the raft protects the crew from being deluged by water when the raft is towed rapidly. See picture on page 35

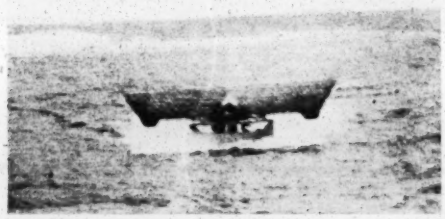


TOWING THE KITE, WITH LIEUTENANT SELFRIDGE ABOARD



ALREADY FOR THE ASCENT

Lieutenant Selfridge can be seen lying down in the manhole. He lay on his face on the ladder floor that had been provided, covered up with rugs to keep him warm, for he was lightly clad in oil-skins and long, woolen overstockings without boots



JUST BEFORE THE ASCENT

KITE WITH MAN ABOARD, FLYING AT A HEIGHT OF 168 FEET

The kite remained in the air for about seven minutes, and then began to come down on account of a decrease in the velocity of the wind. Its descent was so gentle and even that Lieutenant Selfridge, whose view of the water in front was intercepted, did not know it was dropping until it actually touched the water. Photos by Mr John Davidson.

MORE CHANGES OF THE COLORADO RIVER

THE completion of the works at the intake below Yuma early in February, 1907, sent the main current of the Colorado River down the old channel, which it had left empty during the greater part of the previous year. This channel lies near the eastern margin of the delta, and actually cuts into the gravel bluffs of the Sonoran mesa at three places below the international boundary.

The lowest point at which the river finally left this mesa, at about 32° 11′ North, is the center of interest of the present note, for it marks the head of tidal action, and also the location of a depression in the eastern bank from which a shallow trough extended southeastwardly to the shores of the Gulf east of Montague Island. Ordinarily a series of salt pools extend from within two miles of the river down the depression to the Gulf, being known as the Santa Clara Slough.

During a visit to this region in March, 1905, a great volume of flood water was seen to be leaving the main channel and making its way to the Gulf through the Santa Clara Slough, and the prediction was hazarded that a shift of the cutting

action of the water might send the principal current to the sea in this way.*

Shortly after that observation was made the entire stream was diverted into the Salton basin for a time, leaving the bed of the river bare for more than a hundred miles. With the restoration of recent conditions the Colorado resumed its way to the Gulf, but in the mean time such erosion and formation of bars had taken place in the section affected by the tides below the "Colony" mesa that the main current flowed through the Santa Clara Slough, if reports from three different sources are to be credited.

The consequences of this change are somewhat momentous. The main mouth of the river was formerly 20 or 30 miles farther northwest of the new debouchure, and with the converging shores of the Gulf gave conditions which, with the spring tides at from 30 to 40 feet, produced a marked bore, being felt many miles upstream, both in the Colorado and the Hardy. The new channel reaches sealevel by a much more gradual descent and without the strong current and converging shores favorable to developing the bore.

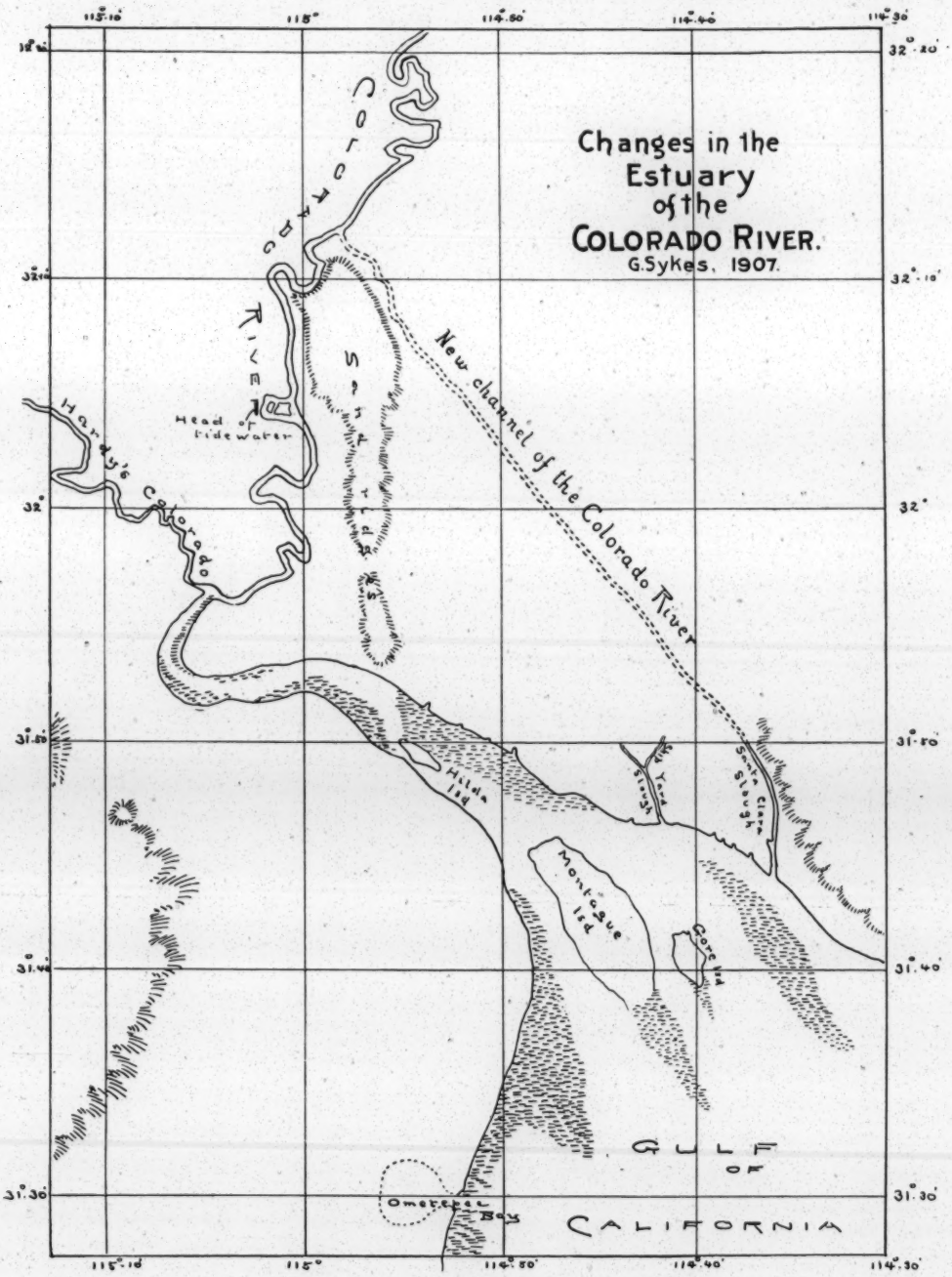
The new mouth will become the center of a new series of mud flats, which fringe the shores already for a distance of 50 miles. The deposition of silt will operate to close the eastern channel between Montague Island and the mainland, which has long since ceased to be navigable and will soon afford material which will be piled by the tides in the deeper channel to the westward, with the final result of filling it more or less completely, thus forming a brackish or saline lake comprising Sargents reach and the Great Horseshoe Curve 50 or 60 miles in length, into which the seepage waters of the Hardy will flow, charged with the salts picked up from the mud volcanoes to the northward. Before the channel is closed, however, the action of the tides will carry salt water far up the channels of both the Hardy and the old estuary, with a pertinent effect on the vegetation on the extensive tide-washed flats.

The new eastern channel is one probably not previously occupied by the river in its present condition, and the change adds to the delta the triangular area enclosed by the old channel below the "Colony mesa" to the Gulf, and the new channel, inclusive of great expanses of mud flats, and a range of gravel dunes or hillocks which find their culmination at the extreme northern end of the triangle immediately below where the new channel takes off from the old one.

In addition to increasing the area of the delta, serious disturbance of the plants and animals over an area of several hundred square miles may ensue. In a large part of it the composition of the flora will be totally altered. It is needless to say that the meager agricultural operations of the few Cocopah Indians who frequent the region will be seriously disturbed. So far as might be inferred from the reconnaisance already made of the conditions of flowage into the Laguna Maqutata, in the extreme western portion of the delta, no serious effect will be apparent in its irregular filling and shrinking by evaporation.

D. T. MACDOUGAL,
Director of Botanical Research,
Carnegie Institution.

* Bull. Amer. Geog. Society. January, 1906.


Changes in the Estuary of the COLORADO RIVER.
G. Sykes, 1907.
COLORADO RIVER
Head of tidewater
Hardy's Colorado
New channel of the Colorado River
Hilda Isd
Montague Isd
Gore Isd
Santa Clara Slough
Ometeepee Bay
GULF OF CALIFORNIA
115°.10'
115°
114°.50'
114°.40'
114°.30'
32°.20'
32°.10'
32°
31°.50'
31°.40'
31°.30'

HONORS FOR AMUNDSEN

THE principal feature of the annual banquet of the National Geographic Society, December 14, was the presentation of the Hubbard Gold Medal of the Society to Captain Roald Amundsen by the Vice-President, Hon. Charles W. Fairbanks. Several hundred guests and members attended the dinner, including representatives from Argentine, Belgium, Bolivia, Denmark, France, Germany, Great Britain, Italy, Japan, Mexico, Norway, and Switzerland, and from all parts of the United States. Toasts were responded to by Hon. J. J. Jusserand, the French Ambassador; Hon. James Bryce, the British Ambassador; Representative Theodore Burton, of Ohio; Hon. Harvey D. Goulder, of Cleveland, and Representative J. Hampton Moore, of Pennsylvania. The President of the National Geographic Society, Dr. Willis L. Moore, acted as toastmaster. The speeches follow.

INTRODUCTION BY THE TOASTMASTER, THE PRESIDENT OF THE NATIONAL GEOGRAPHIC SOCIETY.

On January 13, 1908, the National Geographic Society will be twenty years old.

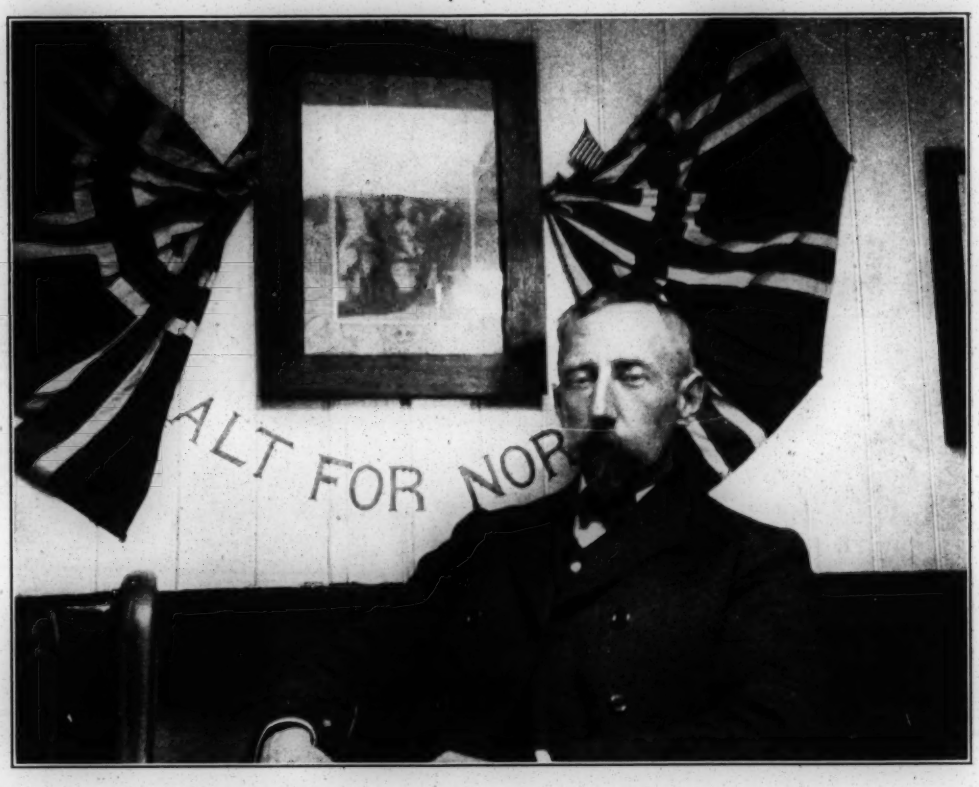
This organization, which is of such comparatively recent inauguration, today numbers a membership of over thirty thousand thinking, educated, working people. Its income is spent entirely in the collection and the dissemination of knowledge that we believe will work for the betterment of humanity. We endeavor to treat of the earth, the waters that cover it, the air that is above it, the configuration of the earth, the boundaries of land and water; and then to teach of the peoples that inhabit the earth—their economic, their political, and their social conditions. From our rostrum speak men who are masters of their subjects. Through our Magazine we disseminate their views throughout the large membership of the Society. Our object is to aid research and diffuse knowledge.

As in warfare "it is the man behind the gun," likewise in every peaceful endeavor it is still the man behind the gun; and, apropos of that, our Society takes pleasure in the fact that among those who direct the operations of this institution there are found such names as Alexander Graham Bell, Robert E. Peary, General Greely, Admiral Chester, of the Navy, Gen. John M. Wilson, of the Army, the former Chief of Engineers. But the list is long. I only refer to a few, so that you may know who are your hosts tonight. We, the members of the Board of Managers and the members of the Society, greet you and extend to you our hospitality.

The first condition requisite to great success in a man is a clear mind and a strong body. Such a condition produces as nearly as may be the perfect composite of the man. We are here tonight first to do honor to one who possesses the strong body and the clear mind, and an acute intellect. We wish to confer the honor of this Society upon him. By unanimous vote its Board of Managers has directed that a medal shall be presented to Captain Roald Amundsen for achieving the Northwest Passage and definitely locating the Magnetic North Pole; and to still further do him honor we are favored with the presence of one who also represents the clear mind in the strong body; for no man could rise to the dignity of Vice-President of these United States who does not possess those qualities. Therefore our Society feels honored by the presence of the Vice-President, and I will introduce him to present the medal to Captain Amundsen.

THE VICE-PRESIDENT, HON. CHARLES W. FAIRBANKS

Mr President, Members of the National Geographic Society, Ladies and Gentlemen: I want to congratulate this great Society upon what it has so splendidly accomplished, upon the work it is doing with such high intelligence and such devotion. The field of its en-



CAPTAIN ROALD AMUNDSEN IN THE CABIN OF THE GJOA

deavor is as wide as human nature and as all-embracing as the world itself.

Captain Roald Amundsen, the pleasant duty devolves upon me to present to you on behalf of the National Geographic Society this gold medal. It is presented to you because of what you have so splendidly accomplished. It is in recognition of your arduous and intelligent service in the great North. It is because of your scientific investigation with regard to the Magnetic North Pole. You have removed many of the doubts, much of the theoretical assumption with respect to the Magnetic North Pole and have established well-authenticated fact with regard to it—an achievement that is yours and only yours since the history of the world began.

This medal is presented to you further because of the fact that you are the first one to sail through the Northwest Passage in your own vessel. Many intrepid and resourceful explorers have for more than three centuries ineffectually attempted what you in God's providence have accomplished. There are many names associated with the attempt to accomplish what you have achieved. Their efforts were not crowned with the same success which have crowned yours; yet they each and all served to reduce greatly the zone of the unknown, and each and all have in a measure contributed to the triumph which finally is yours. I was gratified to read in your modest account of your own achievement the liberal praise you gave to all who have devoted their service to the accomplishment of the Northwest Passage. You are honored here in an especial degree.

It is a happy circumstance that there are assembled at this hospitable board tonight not only men distinguished in

science, in art, in literature, and in statesmanship in the United States, but here are gathered the representatives of the greatest countries upon this globe. The representatives of the chief nations of the earth are met here to do you honor. It has seemed to me always, as I have read the familiar story of the efforts and sacrifice of the explorers of all countries in the Arctic regions, that there is something in it of the heroic, when we contemplate the countless money that has been spent and the scores and scores of lives that have been sacrificed in extending the boundaries of our knowledge in that inhospitable quarter of the earth. I have believed that those who have laid down their lives there are entitled to the same honor the soldier wins when he lays his life down upon the battlefield of his country.

It is a felicitous fact that a Norseman should have first sailed through the Northwest Passage in his own vessel. We have a hospitality for him in this country. Many of our countrymen who dignify and honor American citizenship are fellow-countrymen of yours.

As I said before, this medal is given to you by this great Society because of what you have accomplished in science and in the extension of the domain of geographic knowledge. It is also presented to you because of the esteem of the Society for you personally. I have the very great honor, my dear sir, to present to you this mark of the respect of the National Geographic Society of America.

RESPONSE BY CAPT. ROALD AMUNDSEN

Mr Vice-President, Mr President, and Members of the National Geographic Society, Ladies and Gentlemen: I am highly honored and justly proud of the very high distinction which the National Geographic Society so graciously has bestowed upon me in presenting me with the Society's gold medal. This I have had the honor to receive from the hands of the Vice-President of this great Republic. I am no less grateful for the Society's demonstration of honor by electing me an honorary member of this the largest geographic society in the world. For this splendid token of distinction I have the great honor to express my very sincere gratitude to the members of the Society, among whom there are so many brilliant gentlemen, famous for achievement in scientific research. I see here tonight one whom I think I can say is the most excellent of the scientific explorers in the United States—in fact the most experienced scientific Arctic traveler of the day—Commander Robert E. Peary. I thank you from the bottom of my heart and wish the National Geographic Society all success.

THE TOASTMASTER

In the development of geographic knowledge on this continent there was one nation that was preëminent in exploring the vast interior of what was a great wilds only a hundred years ago. The interior of our country has preserved the names of many of those who first explored it, and given them to its cities. Marquette, Joliet, and La Salle will always be famous as the names of French explorers who entered at the mouth of the Saint Lawrence and passed through the Great Lakes and down the long stretches of the Father of Waters. Now it is appropriate that the ambassador from that nation which had so much to do with carrying a Christian civilization into the interior of this continent should be here to honor us with his presence. He will speak to the toast of the "Northmen's Travelings."

THE AMBASSADOR FROM FRANCE, HON. J. J. JUSSERAND

Once more a deed of valor, of pluck, and endurance has been performed by a Norseman. Valor, pluck, and endurance are highly appreciated in America, where so many connoisseurs and practicers of the same exist. It is in the nature and fitness of things that a Norseman be here tonight and be applauded and recompensed, as he has been, not only by the

medal, but by the eloquent words pronounced by the Vice-President of the United States and by the President of this Society.

Captain Amundsen followed the example of his ancestors. His ancestors may be proud of him, and he in turn may truly, when he goes back in thought towards the origins of his nation, be proud of his ancestors—those ancestors who started from the distant north and went to nearly all parts of the world.

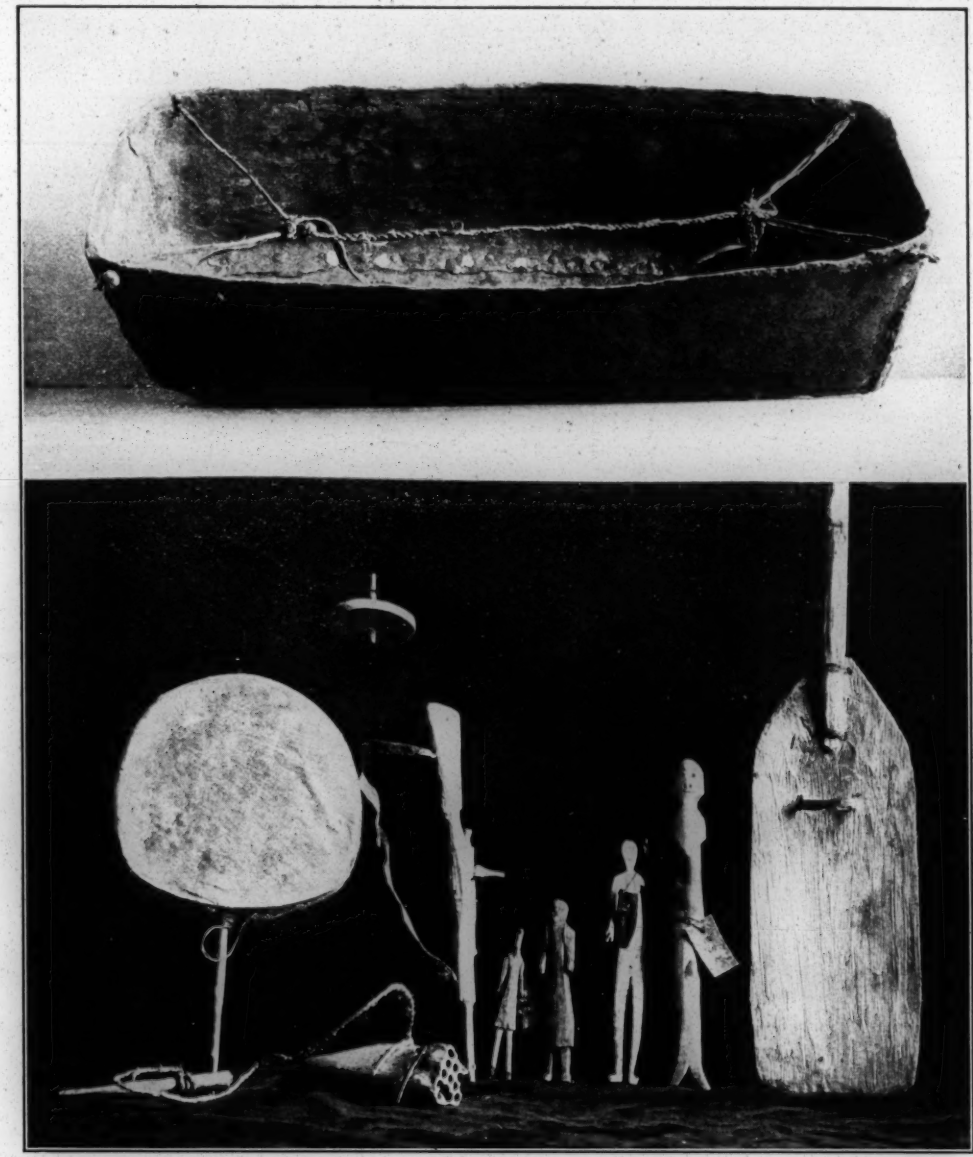
And as in those days all the parts of the world were equally unknown, as there was no National Geographic Society—we have just heard that it has existed only twenty years and I speak of twelve centuries ago—in those days when the whole world was unknown, a Norseman when he started would throw a feather in the air, and in the direction which the wind impressed on that feather, there he would go and discover.

Starting thus, the Norsemen went in every direction, as the wind and their pluck told them. They went to Russia; they founded the Kingdom of Novgorod; they were settled along the tributaries of the Black Sea. They took service under the Byzantine emperors, and some of them stationed in Greece inscribed their names on antique marble lions, as a sentry would nowadays (though forbidden) inscribe his name on his box. Those lions still exist, and many of you may have seen them in Venice, where they were transferred by Morosini in the seventeenth century, and where, sentries in their turn, they keep watch in front of the Arsenal main gate. They still bear on their marble skins the names in runic characters of the Scandinavian defenders of Byzantium.

The same sea rovers, following, as they said, the "swans' path," the "whales' road," went north and went west, settling in France, in England, in Iceland, and Greenland, and visiting America.

I do not think there is any doubt that the first European settlers were men from the north, sailing in those long wooden boats, of which several are preserved in Norway, having been found in *tumuli*. For some time it was doubted that such a feat was a possible one; but the experiment has been tried in our days and has proven successful. At the time of the Chicago Exposition Norsemen again crossed the Atlantic in the same sort of boat as their forefathers. An accurate copy of one of the viking ships dug from the Norway mounds, manned by the same number of men, with the same number of oars, having the same single mast, and no deck, started from Bergen, crossed the Atlantic, where it met some very rough weather, was for some time considered as lost, but it was not lost at all and it arrived in New York quite safely, the men having never had a moment's anxiety. That ship still exists. It is to be seen in Chicago, and in that big city, where there are so many interesting objects to be seen, none is more interesting than this Norsemen's boat.

It is a great honor for me to have been invited to address you and invited in the words your President used. He recalled in touching words my compatriots' contribution to a better knowledge of this country. To this there is no doubt they contributed, and the memory of such men as Laudonière, Joliet, La Salle, Marquette, Bienville, and several others certainly deserves to be cherished, as it is by the National Geographic Society. Some of the earliest maps of the Northern portion of this continent are French maps, drawn by hand, and they are preserved at our Ministry of Foreign Affairs, in Paris. There was, however, a period in French history when the French had a kind of fame that now, I dare say, they have no more. At the time of my youth Frenchmen were famous for their ignorance of geography. This fame we have lost, but I hope we have some other kinds of fame to console us for the loss of that one. For we too have since then emulated, not without some share of success, the deeds of our ancestors. We have begun again to discover countries. The North has not been our special department; it has rather been that of Norsemen, of Americans and



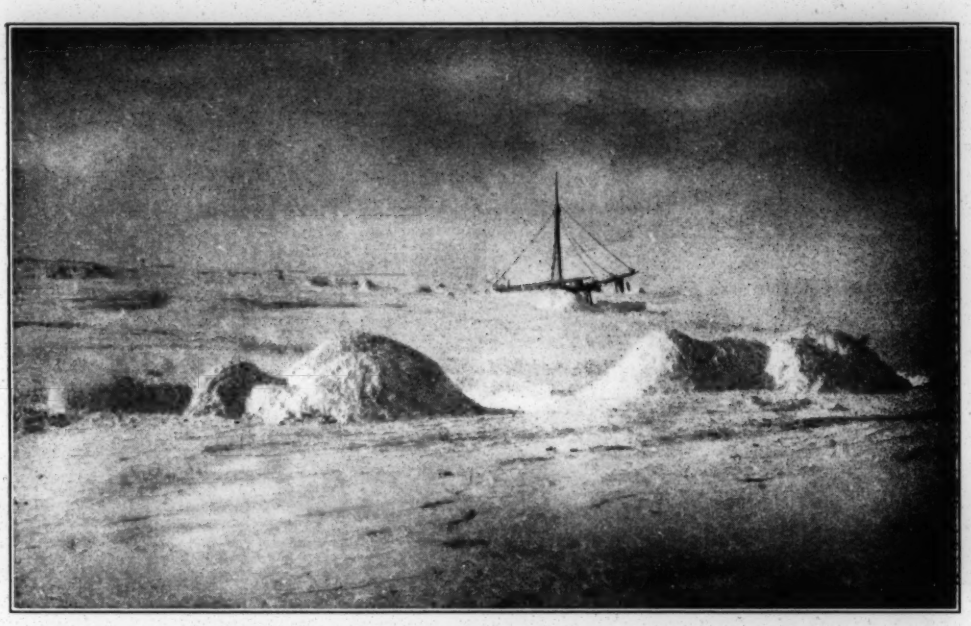
Cooking vessel of the Eskimo at King Williams Land made from copper sheeting of one of Sir John Franklin's vessels; about 15 inches long.

Eskimo toys; these are all in miniature, the snow shovel being about 8 inches long. To the left of it are seen 4 dolls made from wood and bone; then an imitation Krag-Jorgensen rifle, a spinning top, and a tambourine. Lying at the base is a toy with which the children amuse themselves by slinging the stick upward and catching it on one of the holes of the larger pieces. Photos by Captain Amundsen.

Fire-making apparatus, consisting of two pieces of wood, a reindeer bone, and reindeer bow with string.

One of the wooden sticks is spun until by friction against the other it produces a spark which is caught in dry moss.

ESKIMO MEANS OF MAKING FIRE



ESKIMO ENCAMPMENT, KING WILLIAMS LAND

Englishmen; and let us not forget that young, elegant and plucky Duke of the Abruzzi, a worthy compatriot of Columbus and Vespucci, and who was recently in your midst. Some new expedition led through air or through water, by some, maybe, among the men present here tonight, will certainly in the near future gain the first sight of the long-sought North Pole. We traveled mainly in other lands; and many parts of Asia, Africa, and South America, owing to French travelers, are no longer a blank on the map, and "Timbuctu, the mysterious," has no longer any mystery.

Considering so many expeditions undertaken for the sake of mankind at large by men from every land, undeterred by any danger, one goes back in thought to the time when mythical Saint Brandan, the Celtic Saint, started in his leather boat across the great ocean-sea to discover, and actually did discover, the island of Paradise.

Captain Amundsen and his peers make, in their way, somewhat similar journeys. The Geographic Society's guest tonight will not, I am sure, contradict me when I say that, amid the ice, while enduring hard privations and sufferings, he too has discovered the island of Paradise; for to men of heart Paradise is nothing else than duty fulfilled.

THE TOASTMASTER

Some years ago there appeared in public print a book on American institutions written by a foreigner. Other foreigners, especially English, had been to this country. They had remained the length of time necessary for the arrival and departure of a ship, and then had written works on America and American customs; so when this publication on the political conditions of America first appeared it was thought to be a work of the same superficial character as those that had preceded it. But as it was read it awakened interest; as it was studied it commanded admiration, and in course of time Bryce's "American Commonwealth" became the standard text-book on the political institutions of this country. It was

a leaven that was distributed at the right time and it is now bearing a splendid fruition. Millions of young patriotic Americans have received their greatest inspiration from that work. They have learned not only of the strength of the American Republic, but, what is better, they have learned from that great work its weaknesses. Forewarned is forearmed, and today I venture to say there is many a man in the national halls of legislation who is a wiser legislator; there is many a man casting his ballot who today will cast it on the side of righteousness and good government because he read that work written by a fair, impartial, analytical mind; and the National Geographic Society is glad to recognize in that author tonight the Ambassador from Great Britain, who will speak to us on the subject of geography.

THE BRITISH AMBASSADOR,
HON. JAMES BRYCE

Mr Vice-President, Mr President, Members of the National Geographic Society, Ladies and Gentlemen: I thank you, Mr President, for your very friendly and cordial reference to myself, for which I am most grateful. Perhaps, however, you will allow me to enter a very mild and deferential protest against one term which you applied to me. No Englishman, I hope, considers himself when in the United States to be a foreigner.

This, ladies and gentlemen, is a very interesting and a very cheerful occasion. It must be a cheerful occasion to you who have just been informed that your Society now has reached more than thirty thousand members, which I think must be equal to all the geographic societies of Europe put together. You have an abundant revenue which you well spend on the purposes of geography. The occasion is to many of us particularly enjoyable on account of the presence of a distinguished explorer from a nation which has great claims upon the recognition of geographers. He is of the nation whence came the Icelander Eric the Red, who was the first discoverer of America, and who was none the less the discoverer of America because he did not know he had discovered it. And Commander Amundsen is also the fellow-countryman of, I think, the man who performed the most extraordinary feat of daring and endurance in the pursuit of geographical knowledge that the history of the world records, Dr Fridtjof Nansen.

Nevertheless, I always feel a little touch of sadness when I am in a company of people devoted to geography, because geography is to me by far the most attractive and enjoyable of all pursuits, and I have a misgiving that I mistook my vocation when I took to history and politics and did not become a traveler and a geographer. Is there any study or pursuit which has so many sources of enjoyment and is altogether so attractive as the study of geography.

Geography, to begin with, is one of those things which everybody can follow. In many branches of science now the amateur has a hard time. Science has reached such a point of specialistic development that an amateur has practically no chance of making discoveries. But in geography we can all do something. Everybody can do a little bit of exploration, and make it thorough. I don't doubt you all have even done so in the case of some part of the country which was within your reach, and that you have succeeded in knowing a bit of the surface of this earth better than anybody else knew it before. That is something to say in an age like this.

In the next place geography has the great attraction and the immense interest of being the meeting point of all the natural sciences. Geology, botany, mineralogy, zoölogy, meteorology, some branches of physics, such as electricity and magnetism, and of course astronomy also, all touch and flow into geography. It is their meeting point; it takes something from each of them and gather together into one center for its investigations knowledge drawn from these different scientific lines of inquiry which bear upon the constitution of our planet.

GEOGRAPHY IS THE TELEPHONE EXCHANGE OF THE SCIENCES

And, lastly, geography has the unique interest of being the meeting point of the sciences of nature and the sciences of man. What is it, indeed, except a record of all those forms of natural environment which have made man what he is; which have guided his development; which have caused the differences of races; which at every point have influenced his march in one direction or another; which have given him the various forms of institutions; which have developed certain faculties in certain races along certain lines, and which have impressed upon the divers stocks of mankind as they stand now that variety in which the interest of the study of human nature so largely consists. It is this which makes geography the center to which the sciences of nature on the one hand and the sciences of man on the other converge.

Perhaps the greatest progress that has been made of late years in the study of history has consisted in bringing to bear upon it all the data which geography supplies, and in showing how much every nation has owed and must continue to owe to the geographical conditions under which it lives. The relations of geography to history make a fascinating subject, and if we had not many speeches looming up before us tonight I could willingly have followed it out.

There is just one drawback or defect which it has seemed to me attaches to this our favorite science. Its range is limited and is being narrowed. The field open to the geographer is no longer, as it might have been called five hundred years ago, practically infinite and inexhaustible. On the contrary, we are using up the world very fast. I suppose some of the members present remember what the maps of the world were like sixty years ago. I recollect when the whole center of Africa was practically a blank. In the middle of it there were marked upon the map a number of little hillocks, meant to indicate the mountains of the Moon, with figures of lions and elephants scattered here and there. Now the Ruwenzori has actually been climbed.

I remember an ancient terrestrial globe, twirling which and poring over it as it twirled I spent many happy hours, which showed for northwestern America scarcely anything except lines marking the voyages of Cook and Vancouver, and for northeastern Asia very little except the lines which traced the voyages of your illustrious countryman, Mr Ambassador from France, the famous navigator La Perouse.

But things have been greatly altered. Now there is no part of the earth's surface about which we do not know a great deal. Hardly anything is left for the imagination. Moreover, in those days the literary traveler was able to tell any traveler's tale he pleased. Those of you who have written books of travel, and I have no doubt there are some present, well know what is the temptation to the author to improve upon and amplify what he has seen in a little-known country. When I think of what that temptation is and of how often one has to abstain from exaggerating and giving a better turn to something one has seen, I feel like Lord Clive when, in describing the enormous opportunities he had had of increasing his wealth at the expense of the people he was conquering in India, he said, "I stand amazed at my own moderation."

The travelers of the future will have no such chance as some of us have had and some of us have used, let us hope, with moderation in embellishing the narratives of our explorations. I am afraid that the poets and all those who need imagination, who use imagination in literature, must suffer where there is nothing unknown left in the world. But we must make the best of it. We must recognize that our planet after all is limited. What you must begin to do is what has to be done in those parts of the West when the good lands have all been taken up and when it is impossible any longer to get virgin soil for cultivation. You must begin to apply intensive methods of cultivation. You must examine all your territory more thoroughly,

applying all the knowledge you can draw from sciences like geology, botany, and meteorology.

Your National Geographic Society has fortunately a very great and wide field open to it on this continent of North America. You and the Republic of Mexico, whose representative, my friend, Mr Creel, I am glad to see present tonight, have on this vast continent of North America, as we have also up in Canada, an enormous field open in which to conduct a minute scientific study, and the National Geographic Society may look forward to many, many years or centuries of useful activity in tracing down the geographical conditions, the natural history, and the resources and the rainfall and other climatic conditions of this enormous territory.

GEOGRAPHICAL SURGERY

You have also a new field open which seems to be one of peculiar, and indeed novel, interest. I do not quite know what to call it, whether to call it "Remedial Geography" or "Geographical Surgery." It is the taking of the surface of our earth and executing upon it various surgical operations intended to improve it and make it more useful for the service of man. You have embarked in some enormous works on this continent of that nature. You have dealt with the lower course of the great River Colorado, and have contemplated the making of an inland sea in a region which lies a little below the level of the ocean near that stream. You are meditating an enormous enterprise in the improvement of your internal navigation, proposing to construct a great canal and to improve that gigantic river which intersects the middle of your continent—endeavoring to turn it into a more complete and deeper channel for navigation than it has heretofore been. If you accomplish that work, you will have done a thing of which earlier ages might indeed have dreamed, but which nothing but your wealth and the resourses of modern science could have rendered possible.

And, lastly, you have embarked on that splendid enterprise in the Isthmus of Panama. One may say that all these projects come under the head of what may be called "Creative Geography." In attempting this creative policy you are making the world more habitable and profitable for all men. The world is no doubt using up its capital at a very rapid rate. Everywhere minerals and forests are being exploited, perhaps too fast and too recklessly. Here the forests are disappearing swiftly, and the same holds true of Norway. So both you here and we in Britain are using up our metals and our coals very fast. It is quite time that scientific geographers should come in and take stock of these resources and warn the nation, as I am happy to see that the President has already done in very emphatic, but not too emphatic, language, of the necessity of conserving all your natural resources and replacing those which, like the forests, can be replaced.

These are great functions for the National Geographic Society. It has a wide and useful field before it which it has shown that it knows how to work for the benefit of science and of the nation.

I appreciate the honor of having been called to address you and I thank you on behalf of your guests of tonight. I will venture to wish all prosperity and success to the National Geographic Society.

THE TOASTMASTER

The American forests are under the charge of the Agricultural Department. The American forests include areas that in themselves alone are sufficient to support a mighty empire. The Department of Agriculture controls this vast domain, conserves it and protects it, and also has many other important functions: It fights the ravages of insect pests that I do not hesitate to say would be more destructive than the ravages of the army of almost any invading foe. It guards the purity of our food supply. It studies the diseases of plants and animals and checks them. It sends its explorers into the far reaches of the earth to gather plants and animals that may be made economical and profitable to the American people. It develops and it teaches improved methods of husbandry that add hundreds of mil-

lions of dollars to the wealth of the American people. It carries on many lines of research. It distributes knowledge very much as our own Geographic Society does. It forecasts, as you know, the coming of the wind and the storms; and it may be interesting tonight for me to say that only yesterday, as the result of one of the lines of experimentation carried on under the department, an observation made at an altitude of four thousand feet at the experimental observatory at Mount Weather showed the curious anomaly of 38 degrees temperature, while the surface temperature in Washington showed only 24 degrees—14 degrees warmer in the upper layers of the air. The forecast without that upper air observation would have been snow today. But it was apparent to the forecaster that snow could not come from or through that extremely warm stratum of air. This is one of the lines of experimentation that is adding new knowledge to us in a geographic sense.

Now the responsibility for that government department, so beneficent to the American people in all of its purposes, lies in the foresight, the wisdom, and the statesmanship of the Senators and Representatives of the Federal Congress. They have never yet failed to give their cordial support to scientific researches when it meant something to benefit the American people; hence the United States Congress appropriates money—many times the amount of any other country—for the development and the diffusion of knowledge.

Now just a word, if I may, because the Secretary of that department is not here; and that is that that institution is presided over by the greatest practical as well as theoretical agriculturist, I believe, that the world has yet produced.

Unfortunately Senator Beveridge is indisposed and is unable to respond to the toast of the American forests. I look over these faces and I hardly find one that I would call upon without preparation to respond to that toast.

Briefly, it is certain that the welfare of posterity depends upon the protecting and conserving of these vast forest domains. They certainly do much to aid in restraining the floods. They may not change or alter the amount of precipitation, but without any question they do conserve that precipitation. They do restrain the rainfall on the various watersheds. They do render less destructive the floods that come from a given precipitation. The meteorologists are not certain but what the forests actually have an effect upon the thermal conditions, and therefore upon the rainfall itself.

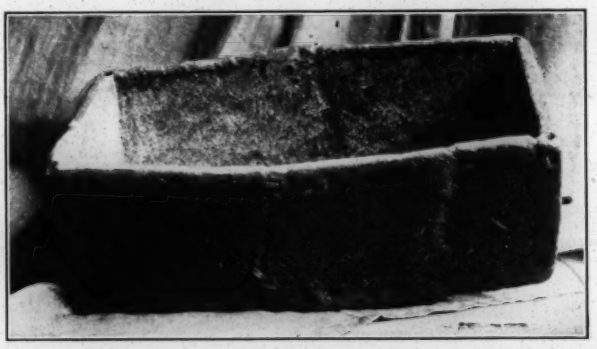
Some recent experiments we have had made of the temperature over the surface of the earth as modified by the earth's covering have shown some very startling results. As an illustration, with contiguous surfaces that were precisely at the same level, thermometers exposed two feet above the surface and not a hundred yards apart would show over vegetation seven degrees lower temperature than over a sandy surface. Many times thermometers exposed over thickly covered vegetation at night would fall far below the freezing-point, while the temperature over the denuded surface would be much above the freezing-point. Hence it may be that the forests themselves, or the denuding of the forests, have really had an effect on the climate itself. The importance of conserving these great areas is conceded by nearly every one. I believe the nation has begun amply early by its wise legislation to protect these great areas for the benefit of the American people.

I remember hearing at one time of a banquet at which speeches were made with relation to the conserving of the waters of the Clyde. At the table there was a young American midshipman, who had partaken probably a little more of his cups than he should have done, so that he was not probably as politic in his remarks at a foreign table as he might have been. He arose and said: "Gentlemen, the Clyde would not form a gargle in the mouth of the Mississippi." Now the Father of Waters will be responded to by one probably who is better qualified to respond to that toast than any other man in the United States, the Honorable Theodore Burton.

THE FATHER OF WATERS. BY HON. THEODORE BURTON

The name "Father of Waters," or "Father of Running Waters," was first given by the Chippewa Indians, located south and west of Lake Superior, because they regarded the river as the greatest in the world. The French explorers accepted this name, May-see-see-bee, and since that day this appellation has been regarded not as a local exaggeration of the aborigines, but as a correct designation for this mighty river.

It is not only customary but appropriate to speak of the Mississippi in superlatives. True, it is surpassed in some particulars by other streams. Its drainage area is not so large as that of the Amazon or the Nile, and is equaled if not excelled by those of the Obi, the Congo, and the Rio de la Plata. There are perhaps ten or twelve rivers that carry to the sea a greater volume of water than does the Mississippi. In the population of the area tributary to it it is exceeded by the Ganges and by at least one river of China. The traffic that is borne upon its waters is far exceeded by that of the Rhine, the Volga, and by other minor rivers of Europe and of the United States. But in all the essential qualities which belong to a great river and a great river valley, as well as in those which make for modern progress, the Mississippi far excels them all.



ESKIMO COOKING POT MADE FROM STONE, AT KING WILLIAMS LAND

The most notable characteristic of the Mississippi is its infinite variety, manifested alike in products, climate, soil and population. This is partially due to the fact that, unlike most of the other leading rivers of the earth, it flows from north to south, and nearly in a direct line.

This same variety is exhibited in the motives and great events which are chronicled in the history of its discovery and the early settlement of the valley. It has been sometimes said that Vespucius, in the year 1498, passed by the mouth of the Mississippi, but the records of his voyages are of such uncertain authenticity that we cannot rely upon them. Other Spanish explorers—Pineda in 1519, Narvaez and De Vaca in 1528—saw the mouth of the Mississippi, but did not enter the promised land. The first expedition to cross the river or travel extensively upon its waters was that of De Soto; his included the flower of the Castilian youth, and was actuated by cupidity, the discovery of the Mississippi in early May, 1541, being a mere incident.

Entirely different in nature were the French explorations of 132 years later. Father Marquette, in 1673, was moved by religious zeal, and when ordered to proceed toward the river wrote of "the happy necessity of exposing his life for the salvation of those nations, and particularly for the Illinois." He passed down from the mouth of the Wisconsin to the mouth of the Arkansas, starting out with the supposition that the great northerly portion of the river flowed to the Gulf of California or the Pacific Ocean. His expedition may be termed a discovery, because it established the identity between the northerly and southerly

MONUMENT IN MEMORY OF SIR JOHN FRANKLIN

Erected on King Williams Land, where the relics of his party were found

ESKIMO AT HERSCHEL ISLAND

portions of the Mississippi. Finally, in 1861, we have the voyage of La Salle, the most untiring and enthusiastic of all the explorers of the West, prompted by desire for adventure, by love of trade, and the wish to add to the domains and increase the glory of France. He passed from the mouth of the Illinois to the very delta of the Mississippi.

Time would fail me if I were to speak of the various influences of different nationalities on the Mississippi River. The Spanish, French, and English all have joined in giving its magnificent valley that cosmopolitan population which is typical of strength and progress the world over.

It was inevitable that this splendid empire should belong to one nation. It was made to be both a geographical and a political unit. In the early days of the Republic this ultimate unity was constantly kept in mind. When, later in our history, an effort was made for the severance of the states bordering upon its waters, those who made that attempt stood athwart the pathway of destiny. Their embattled legions could not succeed, for it was fate that the valley of the Mississippi should be part of a united whole, and that the Mississippi River should flow on to the sea through one great country. Its valley is now, and must in greater degree in the future, assume a preëminent position as the heart of the nation, the source of its great political movements, and the most progressive portion of the globe. Approximately two-fifths of the area of the United States and half of its population belong to this valley.

NO LONGER A HIGHWAY OF COMMERCE

Among the great problems of common interest to all the inhabitants of the valley, the foremost is that of navigation. In the ante-bellum days, the Mississippi was one of the world's great waterways. But for thirty years navigation there has been in its decadence, a condition which has been very correctly depicted by our

foremost American humorist in his book, "Life on the Mississippi," written twenty-five years ago. Models of boats have not been improved; towns have been shut off from connections by railway tracks; facilities for loading and unloading are scarcely better than in De Soto's day; but with the increase of transportation and the recognition of the inadequacy of present agencies and facilities there is no doubt that the time has come when an effort must be made to restore this river to the position it once occupied as a great artery of commerce. And it is perhaps not too bold a conjecture to foretell that the question whether transportation shall be more and more conducted by rail, or whether the rivers of the country shall bear an increasingly important part, will be worked out by trial upon the Mississippi River and its chief tributary, the Ohio.

PREVENTION OF FLOODS BY RESERVOIRS

Another subject which will arouse attention with reference to the Mississippi is the prevention of the enormous floods which create such devastation year by year. Great progress has been made in this regard. The method most relied upon has been that of building levees. In this connection I may say that of late a claim has been made that by the impounding of the waters in the upper portion of the Mississippi and in its tributaries the force of these inundations may be broken. This plan was dismissed as chimerical by the engineers of fifty years ago, but it is again worthy of careful consideration at this time, since topographical surveys now give a better knowledge of the subject. That which seemed entirely impossible in the nineteenth century may be very easy of achievement in the twentieth.

Again, while it may be in part a dream at present, effort should be made for the clarification of the waters of the Mississippi. The chief contributor that makes it a muddy stream is the Missouri, and it has been estimated that each year four hundred million tons of silt are carried along the bed of the river toward the sea—a quantity comparable with and perhaps even greater than the amount of excavation required for the construction of the Panama Canal. Not in a day, nor yet in a year, but in the generations to come, we may hope that this river will be so bettered by the protection of banks and by treatment of soil in the adjacent lands as to remove its present quality of muddiness.

Another problem is the preservation of forests, not only for the sake of the timber supply, but for the moderation of the discharge of waters into the river. Still another, pertaining to many portions of the basin, will be the conservation of waters so that the lands where rainfall does not now exist may be so supplied by irrigation as to open up hundreds of millions of acres for settlement. With great rapidity the resources of this country have been exhausted. It is now time to encourage the practice of economy and conservation. The marvelous wealth of this valley should be preserved for future generations, and provision should be made with great care for the maintenance of that equal opportunity which ought to be the birthright of every citizen of the Republic, but which monopolization at present threatens.

I congratulate this Society for the interest displayed this evening in the conservation and utilization of our resources. I am glad to hear a note of warning sounded, and I hope that by your activities you may exert a beneficent influence in this direction equal to that which you have exerted in other branches of endeavor.

THE TOASTMASTER

In creating the Inland Water Ways Commission for the purpose of studying this great project for the improvement of the Mississippi, the President honored this Society by selecting for the Secretary of that organization one who for years has been one of the most active workers in this institution. I will introduce Dr W J McGee to say a few words.

Dr McGee outlined the objects of the Commission, and referred to the fact that the present agitation to make our rivers more useful to the country is the third waterway movement in our history; the second, directed by Albert Gallatin and encouraged by Thomas Jefferson (then Secretary of State and President, respectively) 99 years ago, unhappily came to naught; but the first agitation, started by George Washington on the Potomac River, led directly to the Annapolis Conference of 1786, and thence to the Constitutional Convention of 120 years ago, in which the Nation found being.

The toastmaster then introduced Mr Goulder as follows:

Some years ago a young man living in the Lake region conceived the idea that he would like to study for the profession of the law. Did he enter a law school? No. He shipped before the mast. He sailed for two years on a sailing vessel, learning every rope and part of its mechanism. From stoker to captain he learned all the various duties of navigating a great steamship, and then he began the study of law, and in course of time became the great admiralty lawyer of the Lake region. He knows all the sailing courses; he knows every port and harbor in the Great Lake region, no matter how small, and is himself interested in vessel properties. I shall ask the Hon. Harvey Goulder, of Cleveland, to respond to the toast of the "Five Inland Seas."

THE FIVE INLAND SEAS. BY HON. HARVEY GOULDER

You have given me a topic, fit subject for a volume, embracing as it does the grandest industrial help to a nation and to the world which history presents. No man may contemplate the use of the Great Lakes, the five inland seas, and their far-reaching effect, without being inspired with greater courage for the future of his own environment.

Geographically speaking, these five great inland seas, with their river connections and outlet, constitute the St. Lawrence system. With the exception of Lake Michigan they mark or line the boundary between us and our friendly and vigorous neighbor for some 1,800 miles.

THE HEAD OF AN ESKIMO FISHING SPEAR

The fisherman thrusts the weapon across the fish's body, which is held by the three prongs.

In 1836 the state of Ohio and the territory of Michigan nearly came to blows about the dividing line between them and in the proposed compromise Michigan rejected the upper peninsula as worthless, but she afterwards accepted it. In 1840, when on application of Michigan a bill was before Congress for a land grant to aid the building of a lock to overcome the 19 foot drop in water level at Sault Ste. Marie, Henry Clay said in a speech, which defeated the particular bill, "it is a work quite beyond the remotest settlement of the United States, if not in the moon."

It was in 1871, when application was made for a land grant to aid a railroad from the twin cities at the head of the Mississippi, to the head of Lake Superior,

ESKIMO HUNTER, KING WILLIAMS LAND

that Proctor Knott ridiculed Duluth, the future great and Zenith City of the unsalted seas.

Last week, a steel freight steamer with every modern convenience for economic transportation, brought down from Duluth through the Sault canal and delivered at Buffalo the largest cargo of wheat ever carried by any ship in the world, 422,000 bushels; enough to make 84,000 barrels of flour, and at 14 bushels to the acre, representing the product of 30,000 acres, approximately 50 square miles; and I have it from official sources that we may take this average. In 1907, in about 232 days of navigation, Duluth shipped in the single item of ore over 13,000,000 long tons, and her sister city across the bay over 7,000,000 tons more.

One-third of all the tonnage under the American flag is employed on the Great Lakes. As an example of the progress of transportation a comparison may be illustrative. In the last fiscal year, of ships of over 1,000 tons custom-house measurement, there were built in other parts of the United States, 18 steel and wooden steamers, ferry boats and schooners, with a tonnage of 41,355 tons. In the same period on the lakes there were built 40 steel steamers, each upward of 1,000 tons, and of aggregate custom-house tonnage of 232,366 tons. It may not be out of place to say that more than 30 of these exceeded 5,000 tons custom-house measurements. The custom-house measurement, it must be borne in mind, represents only something more than one-half the actual dead weight carrying capacity of our lake ships at the draft which they can carry through the shallower connecting waters between the lakes themselves. Therefore, it is that a steel steamer of the prevailing type, say from 556 to over 600 feet length, 54 to 60 feet beam and 32 feet depth carries 10,000, or more, long tons of iron ore on a draft of a little over 18 feet to which connecting waters consign her, and 12,000 to 14,000 tons in such a trade as between Escanaba and the great steel works at the head of Lake Michigan, in which trade the steamer is not required to encounter the restricted draft compelled in the connection betwen Lake Superior and Lake Huron and Lake Erie, by reason of natural conditions which I have not the time to explain.

XUM

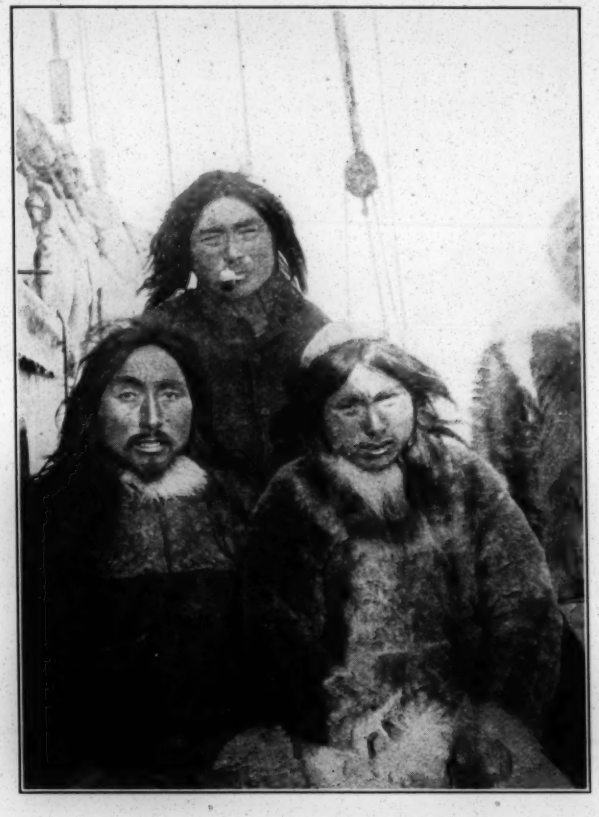
Concurrently have come inventions for the rapid handling of cargo, so that one of these great cargoes of iron ore or grain can be, and some times is, loaded in a couple of hours and unloaded within five hours. Covering a voyage between Lake Erie ports and the head of Lake Superior such a vessel makes a round trip in from 7 to 12 days according as she goes without cargo one way or is loaded each way and subject to congestion at either terminal.

Such has been the progress and demand for transportation that the railroads are so choked, especially at their terminals, that they are, and have been, exhausting every device that ingenuity, involving concurrence of action between railroads and shippers, can suggest to prevent mileage service of the average freight car being reduced below the already alarming point, said to be within past ten years from 30 miles to 20 miles per day.

The Great Lakes system is furnishing in its cheap water transportation about one-third as much ton-mile service in its eight months season as the combined service of all the railroads of the United States in the year.

The average ton-mile cost by our railroads, which is, generally speaking, half or less than the cost in Europe, runs over 8 mills. The favorably located and best equipped may come down to one-half of this but not lower unless we regard a very few exceptional cases to which a general rule could not be applied. The ton-mile cost in the Great Lakes haul is about one-tenth the average of the rail haul and say one-fifth that of the most favored rail routes with the exceptions stated.

While Henry Clay protested, strong, helpful men of business forced a passage between the east and the magnificent northwest of the United States and Canada which we see today. The state of Michigan was induced to take upon herself the building of a lock at the Sault. To accomplish the cherished idea it is said that some of these men traveled 50 miles on snow-shoes through a winter wilderness to attend a meeting, lest the project fail or falter.



ESKIMO AT KING WILLIAMS LAND

It did not fail because it was the destiny of the great American and Canadian Northwest to become the chief grainery of the world. It was the destiny of the United States to become the imperial factor in iron and steel and in industrial pursuits; and the destiny of the United States has never yet halted for lack of human instruments.

So the Indian legend that Gargantua, the great chief and demi-god, when he found the waters of Lake Superior rising, put on his great boots and walked around

the lake until he found at the Sault that the great white beaver had built a dam, and that he kicked away the dam and opened up the intercourse between the lower lakes and the great northwest is not true. It was those sturdy men of Michigan and the East who, foreseeing the almost boundless possibilities of the Northwest, broke the barrier with the prosaic lock and canal which ever since their grateful successors have improved and enlarged till now through this gateway in the two-thirds of the year allotted to our northern navigation there will have passed in this season of 1907 almost, if not quite, 60,000,000 tons of cargo—nearly four times that through the Suez and nearly six times the estimate for the Panama in its tenth year of operation.

The actual saving in freight has in the past single year exceeded all the cost of all the improvements beginning with the first lock in 1855 and throughout the entire chain of lakes. No man, woman, or child in this country but has felt and enjoyed its beneficent influence and results, while people in far-off lands have been distinctly benefited.

From Lake Superior comes this year more than 40,000,000 of iron ore so rich in the metal that it will produce more than 80 per cent. of the output of pig iron for the year in this country, which in turn will equal or exceed the combined output of Great Britain, Germany, and France; and the blessing to humanity, the good hope, and the good cheer of it all is that all the output of all the countries will be needed to meet the advancing requirements of the world. This marvelous development, so in its infancy, is due definitely and directly to the five inland seas.

THE TOASTMASTER

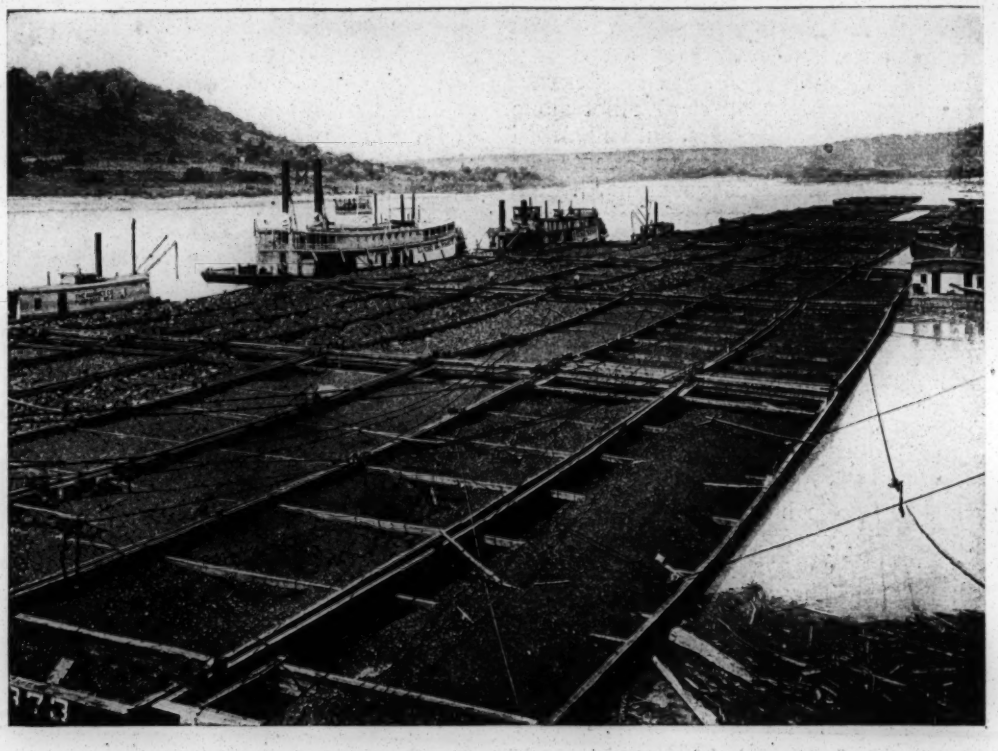
The next toast will be responded to by Hon. J. Hampton Moore, who is a little bit handicapped in name, but what he knows about the water arteries on the Atlantic Coast is not a gift. It was acquired by long and patient study.

THE ARTERIES TO THE ATLANTIC. BY HON. J. HAMPTON MOORE

In the boundaries of the fifteen states along the Atlantic Seaboard the East retains a population of thirty millions of people.

We have started in the East along the Atlantic coast what promises to be a great campaign, hand in hand with our brother of the middle and extreme West, for the development of the waterways of this country. We do not yet quite understand their enormous extent. We have passed beyond the important question of forestry because we have very few forests left. They have been denuded for the purposes of the West, and we have not yet quite come to understand the importance of developing the waterways in the East as some of you have been developing them in the West. But recently, by reason of the congestion of freight traffic, by reason of the incapacity of the railroads of the country to carry the product of the mechanics of the country and of the manufacturers of the country, notwithstanding that they are pushing forward with giant strides, and in my own city of Philadelphia are turning out eight and nine locomotives a day from one of the great works alone; notwithstanding this great development in manufactures, the hand of the artisan and of the laborer and the mechanic, combined with the energy and the capital of the manufacturer, is exceeding the carrying capacity of the railroads and has brought us to a realization of the importance of the waterways as a means of carrying freight, on competitive, or, if you please, on relief lines. We have talked recently of the development of an inland chain. It is not altogether a new idea, but the movement to work for it systematically is of recent origin.

We believe that for the purposes of commerce, as well as for the purposes of war, it would be important not alone to great manufacturing and industrial interests, not alone for the purpose of carrying commodities of heavy, bulky



COAL FLOATED DOWN THE OHIO RIVER TO CINCINNATI

It cost one-third of a mill per ton per mile. The illustration shows a part of a single fleet of barges containing 60,000 tons of coal. Photo from Will L. Finch, Cincinnati

freight, but for the purpose of carrying passengers too.

We should have an inland chain of waterways complete from Boston, on the north, to Beaufort, North Carolina, on the south, a distance of something over a thousand miles, with opportunities to go inland at least 150 miles; these waterways to be serviceable for canal barges, for ships of commerce, and, if you please, for ships of war. We have been thinking, as this question has arisen, of the isolated long seaboard, of the property imperiled, and the lives lost; we have been thinking, too, of those silent vigils of the day and night who constitute the life guard of this country, and who patrol every foot of the Atlantic seaboard, and of our other seaboards while we are snug at home through the wintry season. On the shores of Cape Cod alone, as statistics recently handed to me show, there were, during a period of twenty years following 1881, as many as one thousand wrecks of vessels carrying precious cargoes of human beings and of freight. The development of inland waterways gives courage against the dangers of the Capes, of the shoals of Barnegat, and of the terrors of Cape Hatteras, now almost a graveyard of the seamen of the centuries.

We are hoping the happy time will come when the North and the South will be united upon the proposition to make available for commerce and to make available, if necessary, for purposes of war, though there will be no war with foreign powers while we are represented by foreign ambassadors such as sit about

this board tonight—in fact, to make it available for any emergency. The construction of this great inland waterway, we believe, will be productive not alone of increased manufactures, but will afford an opportunity to the cotton planter of the South to send his goods north at a cheaper and better rate of freight, and will open up the farm lands that have barely been considered in the general waterway agitation up to this time.

If you will take your maps when you return to your homes and draw your finger down the line from Boston to Beaufort, you will see a water-course a thousand miles long, through which you could pass in a small boat from the southern side of Cape Cod, but through which no large boat could pass uninterruptedly, because there is not sufficient depth to make it available for purposes of commerce. There are several strips of land in the way. Cape Cod itself has not been cut through. But one canal is now being cut through by the government of the state of Massachusetts, and another is on the plans for construction. There would be a saving of seventy miles around the perilous shoals of Cape Cod. Following the course down Long Island Sound you would come from the harbor of New York through the Raritan Canal, a distance of 34 miles, across New Jersey to the Delaware River. That canal is entirely too shallow for commerce or war. It should be made deeper and broader to meet the necessities of the oncoming generations. Pass on down the Delaware to the city of Philadelphia. Pass Trenton and Wilmington and come to the state of Delaware, and there you strike the Chesapeake and Delaware Canal. Only thirteen miles of open water-course would carry any vessel not exceeding 9 feet in draft, out into the Chesapeake Bay, and on down the Chesapeake Bay to Norfolk, and then through the Albemarle and Pamlico Sounds out through the sand dunes of North Carolina again into the Atlantic Ocean. You speak of those things that are attractive to you in your geographic studies, those things that are pleasant to you in your scientific research; think of this as a problem of the future; think of this as something that will help to develop this country and unite the sections in bonds of commercial and industrial intercourse; in those bonds which make for the peace and prosperity of the land.

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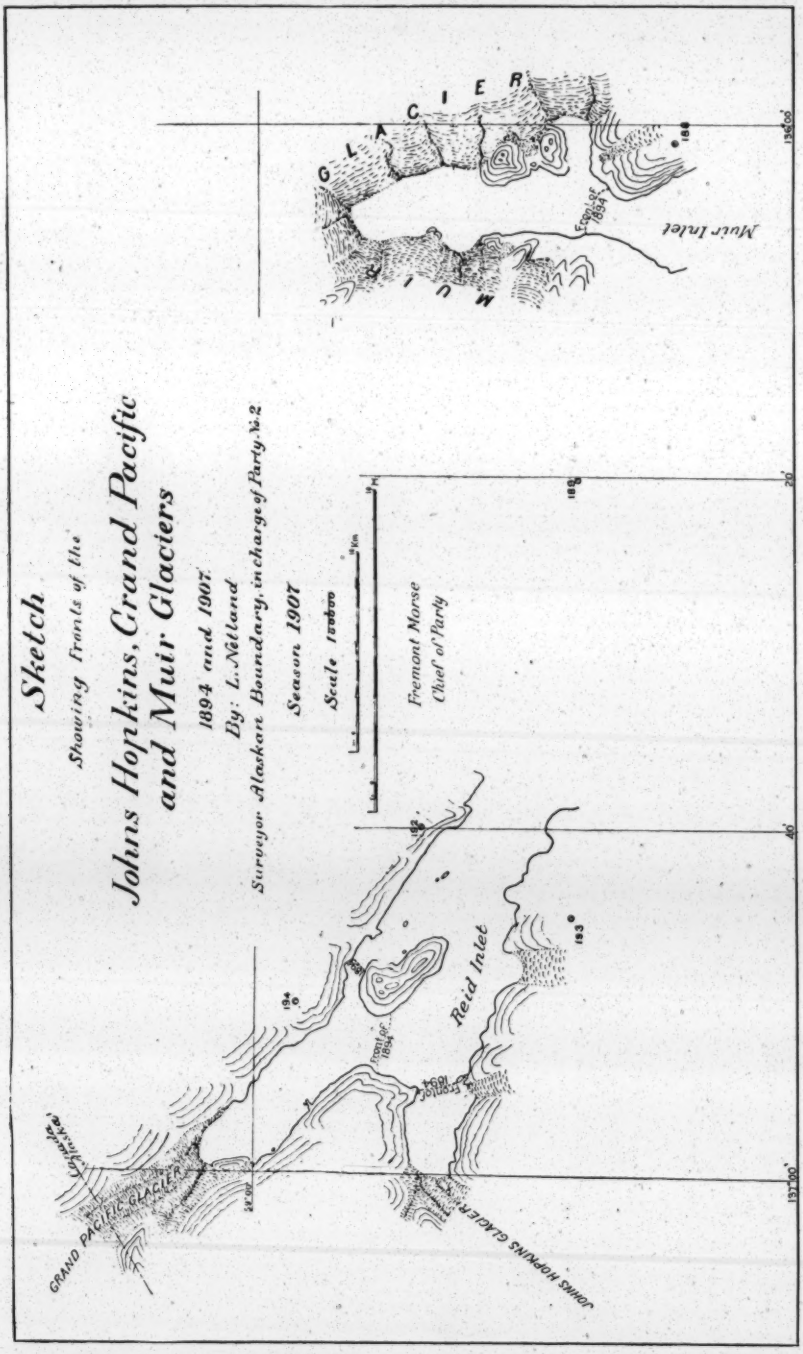
THE RECESSION OF THE GLACIERS OF GLACIER BAY, ALASKA

BY FREMONT MORSE, U. S. COAST AND GEODETIC SURVEY

ONE of the most interesting points brought out in our past season's work in Glacier Bay is the remarkable retreat of the glaciers discharging into that body of water. The surveys made by the Canadian parties in 1894 located the fronts of the glaciers at that time and give us data for an accurate determination of the amount of the recession, when taken in connection with our work this year (1907).

The primary cause of the changes which have taken place can without doubt be traced to the great Yakutat earthquake of September, 1899. At that time an earthquake occurred which was apparently central in Disenchantment Bay, or the upper end of Yakutat Bay, and which upheaved the rocks in that vicinity, by actual measurement, some 30 or 40 feet. In one place it was measured and found to be 47 feet. This great disturbance of the earth's crust profoundly affected the glaciers in Glacier Bay. Previous to that time for many years the excursion steamers of the Pacific Coast

*From a report to Hon. O. H. Tittmann, U. S. Boundary Commissioner.



Steamship Company had regularly run up into the bay, and had experienced little or no difficulty in approaching within a few hundred yards, or as close as it was deemed safe, to the face of the Muir glacier. The earthquake changed all that. The glaciers seem to have been completely shattered by the shock. Vast masses of ice were discharged, which so choked the bay that it was impossible for

steamers to enter. So also the breaking up of the ice masses seems to have been so thorough that great quantities have continued to be discharged every year since then, and it was not until this summer that the excursion boats were able to approach to within less than from 10 to 20 miles of the front of the Muir. The steamer *Spokane,* commanded by the veteran Capt. James Carroll, succeeded in getting up to within about a mile of the face of that glacier on one of her trips this year.

Formerly the Muir presented a perpendicular front at least 200 feet in height, from which huge bergs were detached at frequent intervals. The sight and sound of one of these vast masses falling from the cliff, or suddenly appearing from the submarine ice-foot, was something which once witnessed was not to be forgotten. It was grand and impressive beyond description.

Unfortunately the recent changes in the Muir have not increased its impressiveness from a scenic standpoint. Instead of the imposing cliff of ice, the front is sloping, and seems to be far less active than formerly. Its shape is entirely changed. It is now divided into two branches, the two branches being caused by what were formerly two "nunataks" in the body of the glacier. The eastern arm discharges but little, and appears to be nearly dead. The front of the western arm is in shape of an elongated basin, and, as above stated, slopes gently. It is badly crevassed; a point of rock juts out at the water's edge on the west side of the basin. This is apparently the prolongation of a ridge which outcrops through the ice-field further back, and which will soon, if the glacier continues to retreat at its present rate, make two arms of the present western one. It is from this western arm that the bulk of the ice is now discharged.

That the changes now going on will continue in the same direction is by no means certain. All around Glacier Bay from Bartlett Bay up into Hugh Miller Inlet, and including the Muir Inlet, there are evidences that there was once before a retreat of the glaciers followed by an advance. Stumps of large trees, *in situ,* along the shore line, testify unmistakably that for a long period the country was free from ice, that forests grew, that the ice advanced and overwhelmed them, and has again retreated. Who can predict what will come next?

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Friday, January 31, 1908—"The Conservation of Our Natural Resources." Mr Gifford Pinchot, Chief of the U. S. Forest Service.

Friday, February 7, 1908—"South Africa: The Natives and the Mines." Mr Gardiner F. Williams, author of "The Diamond Mines of South Africa" and for many years General Manager of the De Beers Diamond Mines, Kimberley. Illustrated.

Friday, February 14, 1908—"The Deep-water Route from Chicago to the Gulf and its Connections." Hon. Joseph E. Ransdell, Member of Congress from Louisiana and President of the Rivers and Harbors Congress.

Friday, February 21, 1908—Hon. George Shiras, 3rd, of Pittsburg, has accepted the invitation of the National Geographic Society to address the Society on some of his experiences in hunting wild game with the camera. Illustrated.

Friday, February 28, 1908—"Holland's War with the Sea." Prof. J. Howard Gore. Illustrated.

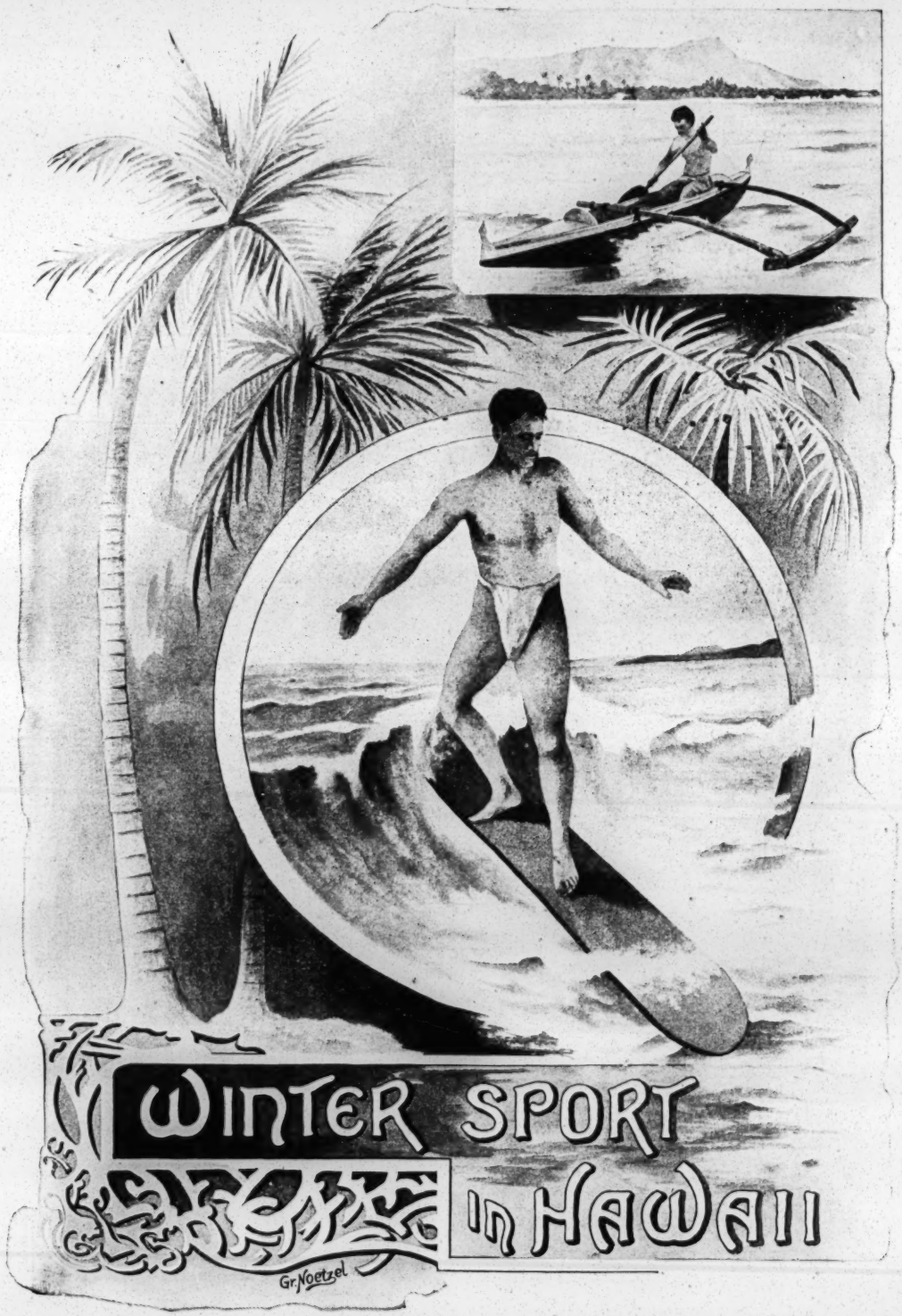
Friday, March 6, 1908—"The Missions of California." Hon. Joseph R. Knowland, Member of Congress from California.

Friday, March 13, 1908—"Arizona—The Egypt of the New World." Mr Frederick Monsen. Mr Monsen describes not only the ancient ruins, but the country as it is today, with its Indian tribes, Spanish-Mexican settlements, and American towns. The wonderful Snake Dance of the Hopis will be shown.

Friday, March 20, 1908—"Persia—Past and Present." Dr A. V. Williams-Jackson, of Columbia University. Illustrated with unusual pictures taken by Professor Jackson on extensive journeys through the ancient kingdom.

Friday, March 27, 1908—"The Geography of the Sea." Rear Admiral Colby M. Chester, U. S. Navy.

Friday, April 3, 1908—"Cathedrals, Mosques, and Temples of the World." Hon. O. P. Austin, Chief U. S. Bureau of Statistics. Illustrated.



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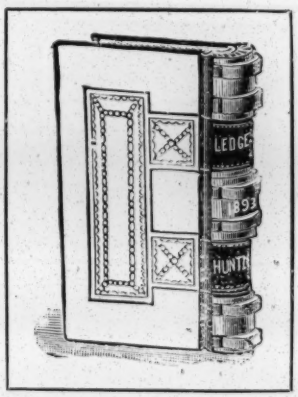

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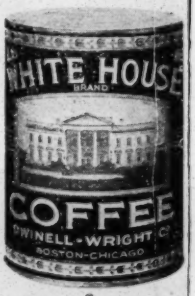

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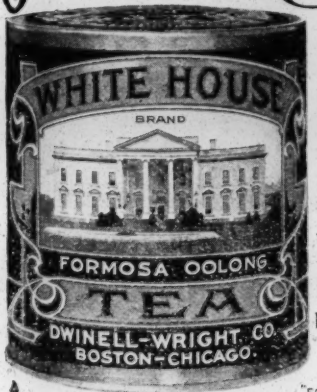

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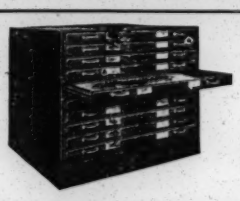

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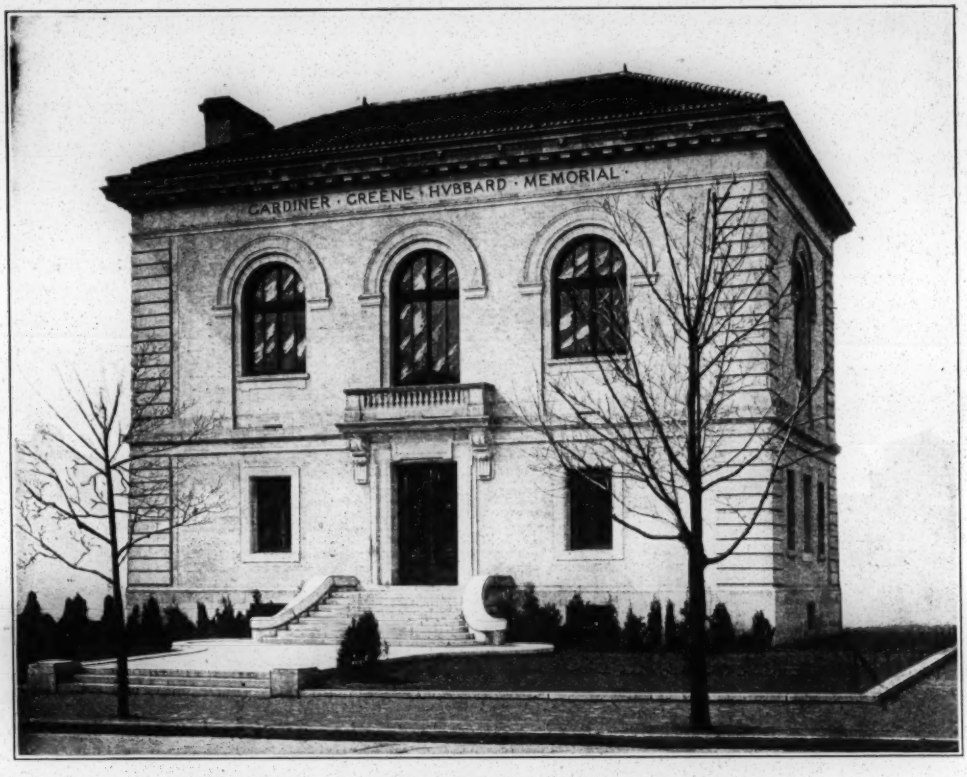

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